

AD-A155 661 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
CHARTPAK DAM MA 00750. (U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV DEC 79

NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
CHARTPAK DAM MA 00758. (U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV DEC 79

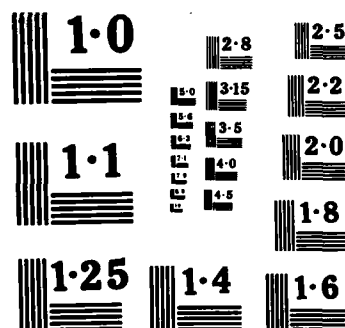
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AD-A155 661

CONNECTICUT RIVER BASIN
NORTHAMPTON, MASSACHUSETTS

CHARTPAK DAM
MA 00758

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

DECEMBER 1979

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

FOR THE
ATTENTION OF
NEDED-E

Honorable Edward J. King
Governor of the Commonwealth of
Massachusetts
State House
Boston, Massachusetts

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JUL 29 1980



Dear Governor King:

Inclosed is a copy of the Chartpak Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. The report is based upon a visual inspection, a review of past performance, and a preliminary hydrological analysis. A brief assessment is included at the beginning of the report.

The preliminary hydrologic analysis has indicated that the spillway capacity for the Chartpak Dam would likely be exceeded by floods greater than 24 percent of the Probable Maximum Flood (PMF), the test flood for spillway adequacy. Our screening criteria specifies that a dam of this class which does not have sufficient spillway capacity to discharge fifty percent of the PMF, should be adjudged as having a seriously inadequate spillway and the dam assessed as unsafe, non-emergency, until more detailed studies prove otherwise or corrective measures are completed.

The term "unsafe" applied to a dam because of an inadequate spillway does not indicate the same degree of emergency as that term would if applied because of structural deficiency. It does indicate, however, that a severe storm may cause overtopping and possible failure of the dam, with significant damage and potential loss of life downstream.

It is recommended that within twelve months from the date of this report the owner of the dam engage the services of a professional or consulting engineer to determine by more sophisticated methods and procedures the magnitude of the spillway deficiency. Based on this determination, appropriate remedial mitigating measures should be designed and completed within 24 months of this date of notification. In the interim a detailed emergency operation plan and warning system should be promptly developed. During periods of unusually heavy precipitation, round-the-clock surveillance should be provided.

NEDED-E

Honorable Edward J. King

I have approved the report and support the findings and recommendations described in Section 7, with qualifications as noted above. I request that you keep me informed of the actions taken to implement these recommendations since this follow-up is an important part of the non-Federal Dam Inspection Program.

A copy of this report has been forwarded to the Department of Environmental Quality Engineering, the cooperating agency for the Commonwealth of Massachusetts. This report has also been furnished to the owner of the project, Times Mirror Inc., c/o Mr. Stanley Galusza, Operations Manager, Chartpak-Rotex Division, 1 River Road, Leeds, Mass. 01053.

Copies of this report will be made available to the public, upon request to this office, under the Freedom of Information Act, thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Quality Engineering for the cooperation extended in carrying out this program.

Sincerely,



MAX B. SCHEIDER

Colonel, Corps of Engineers
Division Engineer

CHARTPAK DAM
MA 00758

CONNECTICUT RIVER BASIN
NORTHAMPTON, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Identification: MA 00758
Name of Dam: CHARTPAK DAM
Town: CITY OF NORTHAMPTON
County and State: HAMPSHIRE COUNTY, MA
Stream: MILL RIVER
Date of Inspection: 14 NOVEMBER 1979

BRIEF ASSESSMENT

Chartpak Dam is approximately 220 feet long including the spillway and has a maximum height of approximately 31 feet. It is a stone masonry structure built in the late 1800's. A 95 foot wide spillway is on the right side of the structure, while a 75 foot wide overflow spillway is on the left half of the structure. There are two outlet openings near the right end of the dam. A 4 1/2 foot diameter pipe, with its gate and gate operator removed, allows water to freely flow from the pool. The second opening, a former sluiceway, is either blocked or sealed. No gate operator is present for the sluiceway. The reservoir is almost entirely silted in.

The facility is considered in poor condition. This classification is based on the condition of the crest of the major spillway. Since 1966, the crest of the spillway has been allowed to unravel and at present 75 percent of the top course and 25 percent of the second course of stones at the crest are missing. It appears that the Owner intends to allow a slow failure to occur at the spillway until the dam breaches itself.

Based on the size classification, small, and hazard potential classification, high, in accordance with Corps of Engineers Guidelines, the selected spillway test flood is the 1/2 Probable Maximum Flood, which has a peak inflow of 25,100 cfs. Hydraulic analysis indicates that the spillway capacity with the water surface at the top of the dam is approximately 11,850 cfs, which is about 48 percent of the routed test flood outflow of 24,770 cfs. The test flood stage is about 4.1 feet above the top of the dam.

Investigations are recommended to determine the safeguards required as the crest stones in the spillway unravel. Recommended remedial measures include the clearing of vegetation from the dam, the removal of an obstruction from the outlet pipe, the clearing of the approach channel to the overflow spillway and the providing of erosion protection at the top of the right end of the dam. The Owner should keep this dam under surveillance during periods of high discharge and/or ice flows. He should also develop a formal maintenance program, operational procedure and emergency procedures plan and should institute a program of annual technical inspections. Alternatives to the self breaching of the spillway are given. The remedial measures and recommendations should be performed within one year of receipt of this report by the Owner.

CAMP DRESSER & McKEE INC.

Roger H. Wood
Roger H. Wood
Vice President



This Phase I Inspection Report on Chartpak Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Richard J. Di Bruno

RICHARD DIBUONO, MEMBER
Water Control Branch
Engineering Division

Aramast Mahtesian

ARAMAST MAHTESIAN, MEMBER
Geotechnical Engineering Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, CHAIRMAN
Design Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I Investigations are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the test flood is based on the estimated "probable maximum flood" for the region (greatest reasonably possible storm runoff), or a fraction thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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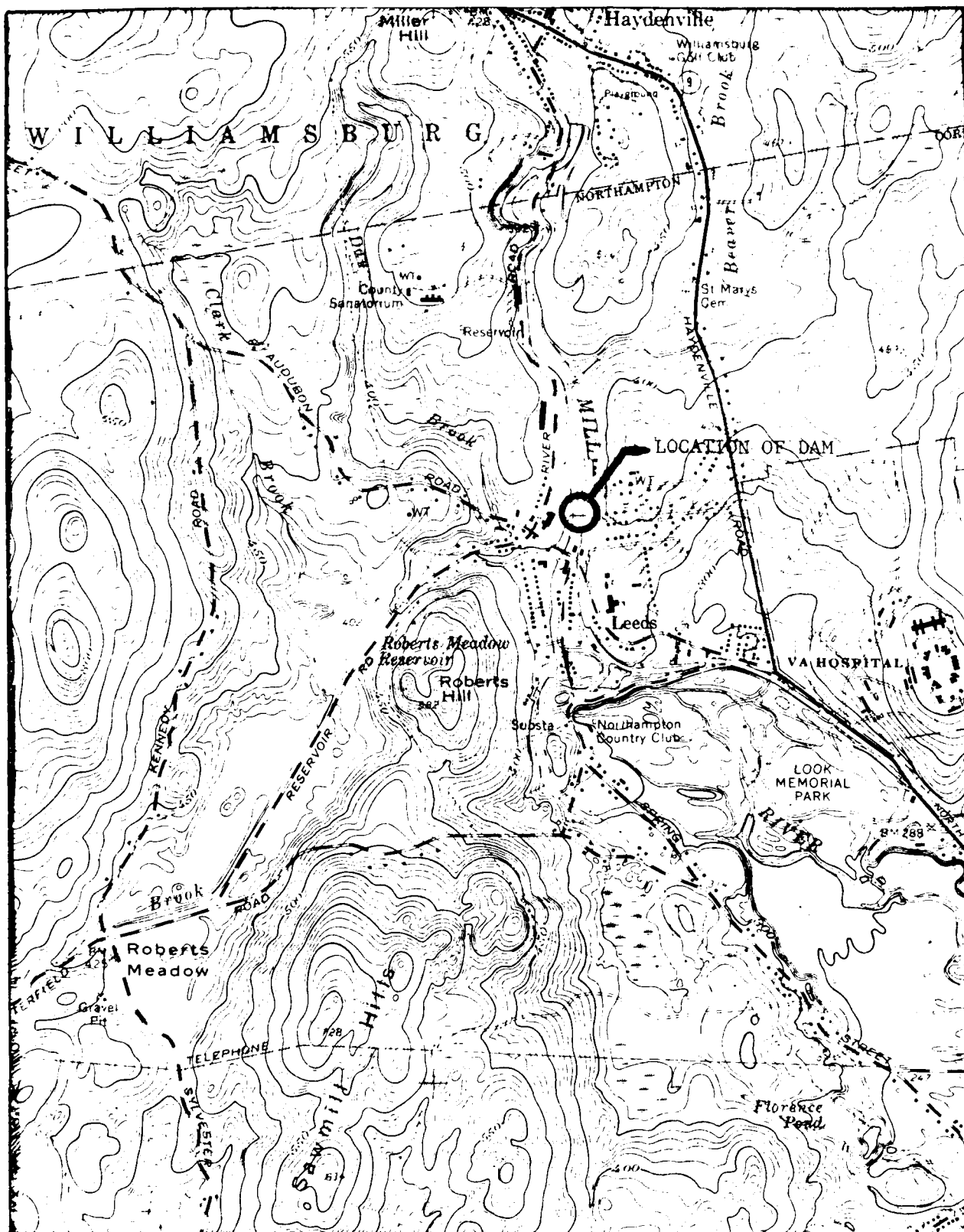
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1. OVERVIEW OF DAM FROM RIGHT BANK.



DAM CHARTPAK DAM

IDENTIFICATION NO. MA 00758



LOCATION MAP
USGS QUADRANGLE

EASTHAMPTON, MA

APPROX. SCALE: 1" = 2000'

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

CHARTPAK DAM
MA 00758

SECTION 1: PROJECT INFORMATION

1.1 General

- a. Authority - Public Law 92-367, 8 August 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region.

Camp Dresser & McKee Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Authorization and notice to proceed was issued to Camp Dresser & McKee Inc. under a letter of 27 March 1979, from Colonel John P. Chandler, Corps of Engineers. Contract No. DACW 33-79-C-0053 has been assigned by the Corps of Engineers for this work. Contract Modification No. P00002, effective 10 October 1979, was subsequently issued by Colonel William E. Hodgson, Jr., Corps of Engineers. Haley and Aldrich, Inc. has been retained by Camp Dresser & McKee Inc. for the soils and geological portions of the work.

- b. Purpose - The primary purpose of the investigation is to:
- (1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.
 - (2) Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.
 - (3) Update, verify and complete the National Inventory of Dams.

1.2 Description of Project

- a. Location - Chartpak Dam is located on the north side of Mulberry Street as it crosses the Mill River in the Leeds section of the City of Northampton, Massachusetts. Access to the west end of the dam is from River Road while access to the east end is from Grove Avenue. The dam is on the Mill River, 7 miles upstream of its confluence with the Connecticut River. The coordinates for the dam are 72 degrees - 42.1 minutes longitude and 42 degrees - 21.3 minutes latitude.
- b. Description of Dam and Appurtenances - The dam is a "run-of-the-river" stone masonry structure about 220 feet long and 31 feet high. The structure spans the entire length of the river and abuts on vertical masonry retaining walls which parallel the river. The dam and abutment walls appear to be founded on ledge consisting of granite and schist units with steeply dipping joints. The ledge rock appears relatively sound.

The main spillway is located at the right center of the dam and is approximately 95 feet wide. The remaining portion of the dam to the left of the main spillway, approximately 75 feet in length, serves as an overflow spillway. Originally, the main spillway had a timber cap. The cap has deteriorated over the years and today there is no trace of it. About 75 percent of the spillway crest stones beneath the former timber cap have also been washed away together with some of the masonry underlying the crest stones. The overflow spillway portion of the dam has a concrete overlay on the upstream and crest portions of the stone masonry. The concrete was apparently placed after the original construction of the dam.

The outlet works includes a 2 foot wide by 3.5 foot high sluiceway, probably the original reservoir drain, and a 4.5 foot diameter pipe, probably the remains of a penstock for the production of power. The sluiceway is located near the right end of the main spillway at an invert elevation of 341.5 +/- . The 4.5 foot diameter pipe is located near the right abutment at an invert elevation of 349.0. The gate operators for both outlets as well as the gate for the 4.5 foot pipe have been removed. The inlet end of the sluiceway is either silted in or has been sealed. Low river flows normally discharge through the pipe outlet rather than through the spillway.

- c. Size Classification - The maximum height of the dam is approximately 31 feet and the estimated total water storage capacity at the top of the dam is 180 acre-feet. According

to guidelines established by the Corps of Engineers, the dam is classified in the small category based both on storage capacity and height.

- d. Hazard Classification - The results of the dam failure analysis indicate that about 12 dwellings, one mill and one road would be affected by the flood wave and the potential loss of life would be more than a few persons. Consequently, the dam is classified in the "high" hazard category.
- e. Ownership - The dam is owned by Times Mirror Inc. The Owner is represented by Mr. Stanley Galusza, Operations Manager, Chartpak-Rotex Division, 1 River Road, Leeds, MA 01053, (Phone 413/584-5446). The prior owner was Avery International Corporation.
- f. Operator - Mr. Stanley Galusza, address and phone number as listed above, is assigned responsibility for operation of the dam.
- g. Purpose of the Dam - At one time, the dam provided power to the Starbuck Mfg. Co. Now there is no known purpose of the dam other than aesthetic reasons.
- h. Design and Construction History - No records of the construction or modifications of the dam are available. According to the present owner, the dam was constructed in the 1890's. A review of prior State and County inspection reports dating back to 1966 did not uncover any reference to repairs or modifications. However, discussions with the Owner's representative indicates that the gate on the 4.5 foot diameter pipe was removed after 1966. The difference in construction materials indicates that the concrete overlay on the overflow spillway was placed after the original construction.

During the years that this dam has been in existence, it has been known by different names. Former names of the dam were Starbuck Dam and Leeds Dam.

- i. Normal Operating Procedure - There is no formal procedure for the operation of the dam. The spillway has a fixed weir crest, the operators for all gates have been removed and the gate on the main outlet pipe has been removed. With the exception of checking the outlet pipe to insure that it is kept clear of debris, no operational work is performed. The condition of the dam reflects the absence of maintenance. The dam no longer serves a practical purpose and has been allowed to follow a natural process of slow deterioration. By 1966, two thirds of the dam's timber cap had been washed

away. This process has continued to the date of the Phase I inspection of the dam on 14 November 1979. At that time, no trace of the timber cap was present and 75 percent of the main spillway crest stones, as well as several stones from the underlying course, were missing.

1.3 Pertinent Data - No elevations were found in the obtained records on the dam. The elevations used in this report are based on elevations for the dam contained in the report on the City of Northampton for the National Flood insurance Program. The elevations are based on the National Vertical Datum (NGVD).

a. Drainage Area - The drainage area tributary to the dam site on the Mill River is 40.2 square miles of varied terrain. The river extends upstream of the dam along State Route 9 to the center of the Town of Williamsburg. It follows a valley which concentrates most of the development in the town. There are four major tributary brooks to the Mill River in this area. These are: Beaver, Nungee, Unquomunk and Joe Wright Brooks located progressively upstream of Chartpak Dam. Mountain Street Reservoir, which appears to be a major project, is located at the headwaters of Beaver Brook. At the center of Williamsburg, Mill River splits into two major branches. The East Branch follows a moderately sloped channel through undeveloped terrain to its headwaters in the southwest corner of the Town of Conway. The West Branch follows a moderately to steeply sloped channel into the Town of Goshen to its headwaters at the Highland Lakes. The terrain beyond the immediate overbank of the Mill River is generally rolling to mountainous.

b. Discharge at Dam Site - The greatest floods at the location occurred in 19 August 1955, 15 October 1955 and September 1938. There are no flow records available for the flood of September 1938. The flood flow recorded at the USGS Gaging Station, installed on October 1938, and located about 3.5 miles downstream of the Chartpak Dam indicated a maximum flow of 6,300 cfs for the August 1955 flood and 5,010 cfs for the 15 October 1955 flood. The drainage area to the Gaging Station is about 54.0 square miles.

- (1) Outlet works size: 54 inch pipe and a 2 ft wide x 3.5 ft high opening. Outlet works capacity at spillway crest elevation45 cfs
- (2) Maximum known flood at damsite: 4,700 cfs in 19 August 1955 (interpolated from gage downstream)
- (3) Ungated spillway and outlet works capacity at top of dam elevation 363.0

Major spillway	10,415 cfs
Overflow spillway	1,100 cfs
Outlet Works.....	335 cfs
Total Capacity.....	11,850 cfs

- (4) Ungated spillway and outlet works capacity at test flood elevation 367.1

Major spillway	18,170 cfs
Overflow spillway	4,350 cfs
Outlet Works	380 cfs
Total Capacity.....	22,900 cfs

- (5) Gated spillway capacity at normal pool elevation N/A

- (6) Gated spillway capacity at test flood elevation N/A

- (7) Total spillway and outlet works capacity at test flood elevation 22,900 cfs @ elev. 367.1

- (8) Total project discharge at test flood elevation 24,770 cfs @ elev. 367.1

c. Elevation (ft above NGVD)

- | | |
|---|------------------------------|
| (1) Streambed at centerline of dam | 332 |
| (2) Test flood tailwater | 349 |
| (3) Upstream portal invert diversion tunnel | N/A |
| (4) Normal pool | 351 max. |
| (5) Full flood control pool | N/A |
| (6) Spillway crest | varies,
350.7 to
360.2 |
| (7) Design surcharge (Original Design)..... | Unknown |
| (8) Top of dam..... | 363 |
| (9) Test flood design surcharge..... | 367.1 |

d. Reservoir

- | | |
|--|------------|
| (1) Length of test flood pool | 0.75 miles |
| (2) Length of normal pool | 0.4 miles |
| (3) Length of flood control pool | N/A |

e. Storage (acre-feet)

(1) Normal pool	5.5
(2) Flood control pool	N/A
(3) Spillway crest pool	5.5
(4) Top of dam	180
(5) Test flood pool	264

f. Reservoir Surface (acres)

(1) Normal pool	5.5
(2) Flood control pool	N/A
(3) Spillway Crest	5.5
(4) Test flood pool	32
(5) Top of dam	22

g. Dam

(1) Type	Gravity stone Masonry
(2) Length	Approx. 220 ft.
(3) Height	Approx. 31 ft.
(4) Top width	varies 5.5 ft. min.
(5) Side slopes	Est. 1:1 U/S, Vert. to 1H: 4V D/S
(6) Zoning	Unknown
(7) Impervious Core	N/A
(8) Cutoff	Unknown
(9) Grout Curtain	Probably None

h. Diversion and Regulating Tunnel None

i. Spillway

(1) Type Broad crested stone masonry

(2) Length of weir and crest elevation (major spillway)
25 ft @ 350.7 ft, 47 ft @ 353.2 & 23 ft @ 355.7

(3) Length of weir and crest elevation
(overflow spillway) 75 ft @ 360.2

(4) Gates None

(5) U/S channel Silted channel of Mill River

(6) D/S channel Mill River with ledge invert

j. Regulating Outlets - There are no regulating outlets remaining at the dam. The former sluiceway with a 2.0 ft wide by 3.5 ft high discharge opening and 341.5 invert elevation has been sealed or blocked by silt. The gate operators for the sluiceway has been removed. The 4.5 ft diameter outlet pipe with an invert elevation of 349 has had both the gate and operator removed. The pipe now allows for the free flow of water from the pool.

SECTION 2: ENGINEERING DATA

- 2.1 Design Records - No design records were located for the dam.
- 2.2 Construction Records - No records of the original construction or modifications were located.
- 2.3 Operation Records - No operation records other than inspection reports by the County and State were located.
- 2.4 Evaluation
 - a. Availability - No records for the dam other than prior inspection reports were located.
 - b. Validity - There are no known design, construction, or operating records.
 - c. Adequacy - The absence of known records of the design, construction and/or modification requires that the evaluation of the dam during this investigation be based primarily on the visual examination described in the following section. The evaluation is aided by the concern in the last thirteen years over the deterioration of the main spillway. This led to frequent inspections of the facility and detailed descriptions of the state of deterioration observed during the inspections.

SECTION 3: VISUAL INSPECTION

3.1 Findings

- a. General - The Phase I visual examination of Chartpak Dam was conducted on 14 November 1979. While the remaining portion of the dam is in fair condition, the major spillway is in poor condition. It is slowly failing as the crest stones are being allowed to be displaced by flood flows and ice pressure. At the time of the inspection, a good portion of the top course and some of the second course stones were missing from the major spillway. The reservoir level at the time of the site examination was 0.3 ft above the bottom of the second course of stones in the major spillway. Water was discharging through the area of missing stones and through the 4.5 ft diameter pipe outlet.

Visual inspection checklists are included in Appendix A and selected photographs are given in Appendix C. Prior inspection reports dating back to 1966 documenting the rate of deterioration of the major spillway are included in Appendix B.

- b. Dam - Chartpak Dam is almost entirely of stone masonry as shown in Photo 1, 2, and 6. The top of the major spillway was reported to be originally protected by timber planking. None of the timbers remains on the exposed portion of the structure. The top of the rubble stone core is exposed at the top of the major spillway as shown in Photo 3. Approximately 75 percent of the top course and 25 percent of the second course of stones in the spillway are now missing, as shown in Photos 1, 2, 8 and 9. Some of the cap stones directly over the rubble core at the right end of the dam (the former operating platform for the outlet pipe) are also missing. The unprotected areas have vegetation present including bushes. The overflow spillway (the left side of the dam) is protected by a concrete overlay as shown in Photos 6 and 7. The overlay is cracked and has either displaced areas or sections were placed out of alignment. Upstream of the dam, the pool is almost entirely silted in as shown in Photo 4. Considerable brush is present at the approach to the overflow spillway as shown in Photos 6 and 7 and may reduce its discharge capability during flood flows.

The downstream face of the dam is generally in good condition. Vegetation in the form of grass is growing in a limited amount of the masonry joints as shown in Photo 2. Several

of the face stones at the juncture of the major spillway with the right end of the dam appear to be slightly displaced as shown in the same photo. Three small pressure leaks were observed between the area where water is flowing over the spillway in Photo 2 and the sluiceway outlet.

A pool is present at the base of the left downstream side of the dam as shown in Photo 6. The pool is formed by a natural depression in the rock surface which is above the elevation of the river channel. A slight flow was occurring from this pool towards the river. The pool may be associated with flow through discontinuities in the rock foundation materials. Similar seepage may be present at other locations along the base of the dam which were obscured by flowing water. No evidence of solutioning was observed nor would it be expected in connection with seepage through the granitic and schist foundation rock.

The observed portion of the foundation of the dam consists primarily of schist and some granitic rock. Much of this rock is highly foliated, and steeply dipping joint sets are evident. However, the rock foundation materials, where visible, appear sound. No evidence was observed of displacements that might have been caused by foundation movement.

c. Appurtenant Structures

- (1) Outlet Works - The gate and gate operator are no longer present at the 4.5 ft diameter pipe outlet. Water was flowing through the pipe as shown in Photo 2, but the flow was obstructed by what appeared to be a tree trunk in the pipe. The 2 ft wide by 3.5 foot high sluiceway outlet near the right end of the major spillway also did not have a gate operator present. The sluiceway is either blocked by silt or sealed, since no water was observed being discharged from this outlet.
- (2) Abutment Walls - Stone masonry walls parallel to the river are present at both abutments. The wall on the right side has a relatively low height while the wall on the left side approaches the height of the dam as shown in Photo 7. Both walls appeared to be in good alignment and no evidence of settlement was observed. While some of the top course of stones are missing from the walls on the right side, the walls are considered to be in good condition.

- d. Reservoir Area - The immediate banks of the Mill River near the dam are not developed, there is some development 300 to 400 ft from the shoreline and little to no development beyond that point. The sideslopes to the channel bank are flat on the right side and moderate to steep on the left side. The reservoir area is silted as shown in Photo 4 and impounds 5.5 acre-feet of water at the low point of the spillway crest.

Although some of the sideslopes to the river are moderately steep, there appears to be no significant potential for landslides into the pool which would create waves that might overtop the dam. No conditions were noted that might result in a sudden increase in sediment load into the pond.

- e. Downstream Channel - The Mill River is contained on the left side and part of the right side by a stone masonry wall down to Mulberry Street, located approximately 500 ft downstream of the dam. The sides of the channel are overgrown with trees as shown in Photo 5. The invert of the channel near the dam appears to be ledge but does contain stones lost from the dam itself. Downstream of Mulberry Street, the Mill River traverses a developed area before reaching Northampton Country Club. Mill River joins the Connecticut River approximately 7 miles downstream of Chartpak Dam.

- 3.2 Evaluation - The major spillway is being allowed to slowly fail by unravelling. At the present time, the deterioration is confined to the major spillway itself. However, if the continued loss of stones from this spillway undermines adjacent portions of the dam during flood flows, it could result in a sudden increase in the discharge from the dam. The dam is therefore considered in poor condition.

Other conditions noted during the site examination are considered to be minor deficiencies except for the obstruction in the outlet pipe. The obstruction should be removed to allow the pool to be kept at as low an elevation as practical.

SECTION 4: OPERATIONAL PROCEDURES

- 4.1 Procedures - There is no formal operational procedures for the dam. The dam serves no practical purpose for the Owner. The only maintenance work performed on a routine basis is the removal of obstructions from the outlet pipe.
- 4.2 Maintenance of the Dam - The dam, for all practical purposes, is receiving no maintenance except as stated below.
- 4.3 Maintenance of Operating Facilities - There are no operating facilities remaining at the dam. The gate and gate operator have been removed from the pipe outlet. The gate operator has been removed from the sluiceway and either the sluiceway has been sealed or it has become blocked with silt. The pipe outlet is checked weekly to insure that there is no obstruction to the free flow of water.
- 4.4 Description of Any Warning System in Effect - There is no established warning system or emergency preparedness plan in effect for this structure.
- 4.5 Evaluation - Maintenance on the facility is minimal. The dam is being allowed to slowly fail. Formal operational procedures, maintenance programs, warning system and emergency preparedness plans should be established for the dam.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

- a. General - Chartpak Dam is a "run-of-the-river" project on the Mill River at Northampton, Massachusetts. The watershed is 40.2 square miles of mostly rolling terrain. At the lowest spillway crest, elevation 350.7 National Geodetic Vertical Datum, (NGVD), the reservoir storage is 5.5 acre-feet and increases to 180 acre-feet at top of dam (El. 363). The major spillway is a stone masonry structure about 95 ft long, while the overflow spillway has a length of 75 feet and a crest elevation of 360.2. The outlet works is located at the right end of the spillway. The outlet pipe with an invert elevation of 349 is ungated and has a free water discharge. The dam is basically a high spillage-low surcharge project.
- b. Design Data - No hydraulic/hydrologic design data for the dam was located.
- c. Experience Data - The flood of record for the dam occurred on 19 August 1955. The flow recorded at the USGS Gaging Station located at Northampton, MA about 3.5 miles downstream of the Chartpak Dam was 6,300 cfs with a corresponding gage height of 11.78 feet above the "zero" of the gage, which is at elev. 140.0 (NGVD). The 15 October 1955 flood peaked at 5,010 cfs. The flood of September 1938 was also a major event for the area, but there are no available records of the Mill River discharge because the Gaging Station was not established until October 1938.
- d. Visual Observations - The visual inspection of the dam was made on 14 November 1979. At the time, the water depth over 25 percent of the major spillway length was about 0.3 feet. The water depth upstream of the dam was very shallow due to siltation of the pool, and the freeboard was about 12 feet. The spillway was in disrepair with about 75 percent of the spillway crest stones missing. The downstream channel was flat with stone masonry walls along the left bank and some of the right bank. The gate to the outlet conduit at the right spillway abutment has been removed and the sluiceway at the face of the spillway was silted in or sealed.
- e. Test Flood Analysis - Based on the Corps of Engineers Guidelines, the recommended test flood range for the size (small) and hazard (high) is a 1/2 PMF to 2 PMF (Probable Maximum Flood). A 1/2 PMF was adopted as the test flood for this

project. The test flood was calculated using the Corps of Engineers "Guidelines for Estimating Maximum Probable Discharge in Phase I Dam Safety Investigations". The watershed is about 40.2 square miles of "rolling" to "mountainous" terrain with some storage along Beaver Brook, located on the east bank of the Mill River. Based on these watershed characteristics, the 1/2 PMF peak inflow rate of 625 cfs per square mile was selected for this project. The resulting peak test flood inflow to Chartpak Dam would be approximately 25,100 cfs.

The routed test flood outflow is 24,770 cfs at a stage of 367.1 including outlet works capacity. The depth of water over the major spillway would be a maximum of about 16.4 feet. The total spillway and outlet works capacity with water surface at top of dam is about 11,850 cfs or approximately 48 percent of the routed test flood outflow. The total spillway capacity includes a major spillway discharge of 10,415 cfs, an overflow spillway discharge of 1,100 cfs, and an outlet works discharge of 335 cfs.

- f. Dam Failure Analysis - Both wet and dry weather dam failures were analyzed. Based on the Corps of Engineers Guidelines for estimating Dam Failure Hydrographs, and assuming a dry weather failure would occur along the length of the major spillway (95 ft.) and above the line of siltation as measured at the outlet works. The peak dry weather failure outflow would be 830 cfs. Based on the same guidelines and assuming a failure of the overflow spillway above the line of siltation as measured at the left abutment of the major spillway, (see sketch on page D-9) the peak wet weather dam failure outflow would be about 13,200 cfs. The dry weather failure assumes zero flow over the spillway and a water level at spillway crest (EL.350.7) prior to failure, while a wet failure assumes a water level at the top of the overflow spillway (EL.360.2) with the corresponding major spillway discharge (about 6,250 cfs) and downstream flooding conditions prior to failure.

The dry weather failure would not overtop the normal river channel and the resulting hazard would be "low". In the event of a wet weather failure, downstream conditions would be very different. The major spillway discharge would be about 6,250 cfs prior to a dam failure, which is somewhat less than the 50-Year Flood discharge of 6,800 cfs as determined in the November 1976 Flood Insurance Study for the City of Northampton, MA by the U.S. Army Corps of Engineers, New England Division. A discharge of 6,250 cfs would raise the water level just slightly above the river banks in the vicinity of Old Shepard Road, located about 1800 ft downstream of the dam, and some backyards would be flooded as a

result. The additional flow resulting from a failure of the overflow spillway would raise the total discharge to 13,200 cfs which would be slightly greater than the 500-Year Flood discharge of 13,000 cfs determined in the Flood Insurance Study. Based on the Flood Insurance Study water surface profiles and CDM field observations, the resulting flood wave would be contained within the normal river channel between the dam and Mulberry Street, located about 500 ft downstream of the dam. Between Mulberry Street and Old Shephard Road, about 1300 ft further downstream, the flood wave would rise about 7 feet above the existing base flow and seriously endanger about 8 homes. The water level would rise to about window sill elevation at the mill near Mulberry Street. Between Old Shephard Road and Main Street about 1,000 ft further downstream, the flood wave would rise about 6 to 8 feet and flood three to four more dwellings before dissipating in the flood plain at the Northampton County Club. Thus, the hazard resulting from a wet weather dam failure would be "high".

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

- a. Visual Observations - There was no observed evidence of overall instability of the dam during the site examination. The dam appeared to have good alignment with no observed indication of major settlement or tilt. No evidence was observed of significant weathering or solutioning of the exposed foundation rock. Seepage which may occur through openings in the foundation rock is not considered an indication of instability. The three minor pressure leaks observed in the downstream face of the spillway are discharging only a small flow of water under a low head. They are not sufficient in magnitude to cause concern over the stability of the structure at this time.

Local failures have and are taking place in the stone masonry at the crest of the major spillway. Approximately 75 percent of the cap stones and 25 percent of the stones in the second course are now missing. The action causing the loss of stones appears to be erosion by the flow of water over the spillway and/or displacement of the stones by ice pressure rather than instability of the spillway itself.

- b. Design and Construction Data - No design or construction data was located during the investigation. Although the plan dimensions of the dam are known and portions of the foundation material (ledge) are exposed, the available information is not adequate for a theoretical investigation of the stability of the dam.
- c. Operating Records - There are no operating records for the dam other than State and County inspection reports. The reports obtained cover the period from 1966 to 1976 and are included in Appendix B. Although the reports deal with the entire dam, they particularly focus on the unravelling of the stone work at the crest of the major spillway. A review of the reported missing stones in the various reports indicates that the damage did not occur at one time or during one flood but is a result of a continued loss of stones over the past thirteen years. However, any evaluation of this process should consider that the major floods on this watershed occurred outside of this time period.
- d. Post-Construction Changes - Due to the absence of design, construction, and operational records, it is not known if there have been significant post-construction changes.

The presence of a concrete overlay on the stone overflow spillway (the left side of the dam) for a structure believed to be constructed in the 1890's indicates that the concrete overlay is a post-construction change. The removal of the gate operators and the gate for the 4.5 foot discharge pipe is a recent change to the structure to keep the pool elevation as low as practical.

- e. Seismic Stability - Chartpak Dam is located in Seismic Zone No. 2 and in accordance with recommended Phase I Guidelines, does not warrant seismic analysis.

SECTION 7: ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

- a. Condition - The visual examination of Chartpak Dam revealed no evidence of basic instability or other condition which would warrant urgent remedial action. However, the stone crest of the major spillway has been allowed to unravel since 1966. At the present time, most of the top course of stones and 25 percent of the second course of stones are missing from this spillway. The overall condition of the project is considered to be poor based primarily on the deteriorated spillway.
- b. Adequacy of Information - The evaluation of the dam has been based primarily on the visual examination, past inspection reports and application of engineering judgment. The information available or obtained was adequate for the Phase I assessment. However, it is recommended that additional information relative to the unravelling of the spillway be obtained as outlined in Section 7.2.
- c. Urgency - The recommendations for an additional investigation and remedial measures outlined in Section 7.2 and 7.3 respectively, should be undertaken by the Owner within one year of his receipt of this report.

7.2 Recommendations

It is recommended that the Owner arrange for the following investigation to be performed by a qualified registered professional engineer. The Owner should implement corrective measures as required based on the engineering evaluation.

- (1) An engineering investigation to determine the rate of unraveling of the spillway stonework, the conditions which effect the rate of unravelling, the work required to keep the rate of unravelling under control to minimize the potential of a rapid failure and/or undermining the portions of the dam adjacent to the spillway. The spillway should be kept under the observation of a qualified registered engineer, especially during periods of high discharges and/or ice flows, until the dam poses no hazard to the downstream developement.

7.3 Remedial Measures

- a. Operation and Maintenance Procedures - It is recommended that the following remedial measures be undertaken by the Owner to correct deficiencies noted during the visual examination.
- (1) Remove the obstruction from the 4.5 foot outlet pipe.
 - (2) Clean the crest of the dam of vegetation including brush. Remove vegetation from the downstream face of the dam.
 - (3) Clean the approach to overflow spillway (the left side of the dam) of trees and brush.
 - (4) Provide protection to the exposed rubble core at the former operating area on the right end of the dam.
 - (5) Provide surveillance of the dam during periods of high discharges over the spillway.
 - (6) Prepare an emergency preparedness plan and warning system.
 - (7) Establish a formal maintenance program and operational procedure. The maintenance program should include work necessary to minimize an acceleration of the rate of deterioration of the spillway. The operational procedure should focus on keeping the outlet pipe clear of obstructions and keeping the spillway under observation during high discharges.
 - (8) Institute a program of annual technical inspections.

7.4 Alternatives - There are several alternatives to attempting to control the rate of unravelling of the major spillway. They are as follows:

- (1) Reconstruct the spillway to its original crest elevation. The reconstruction should provide protection to the erodeable rubble core. A hydrologic-hydraulic study should be performed prior to such reconstruction to insure the discharge capacity of the resultant spillway will be adequate.
- (2) Remove existing stonework to form a uniform spillway crest at the approximate low point in the existing crest and provide protection to the erodeable rubble core.

- (3) Breach the dam. The environmental impact of breaching dam should be investigated before such action is taken.

Alternative (1) will increase the hazard potential of the dam while the other alternatives will decrease it.

APPENDIX A
INSPECTION CHECKLIST

Page No.

VISUAL INSPECTION PARTY ORGANIZATION

A-1

VISUAL INSPECTION CHECK LIST

Embankment: Dam
Spillway
Outlet Works

A-2
A-3
A-4

VISUAL INSPECTION PARTY ORGANIZATION
NATIONAL DAM INSPECTION PROGRAM

DAM: Chartpak Dam

DATE: 14 November 1979

TIME: 1300

WEATHER: Overcast; 55° F

WATER SURFACE ELEVATION UPSTREAM: Approx. 0.3' below original weir
crest

STREAM FLOW: $Q = CLH^{1.5} = 2.8 (27') (0.3)^{1.5} = 12^+ \text{ cfs}$

INSPECTION PARTY:

1. Roger H. Wood - CDM
2. John Critchfield - Haley & Aldrich
3. Richard Brown - Haley & Aldrich
4. Joseph R. Araujo - CDM (7 November 1979)
5. _____

PROJECT FEATURE	INSPECTED BY	REMARKS
1. <u>Structural/Operations</u>	<u>Roger Wood</u>	
2. <u>Embankment</u>	<u>John Critchfield & Richard Brown</u>	
3. <u>Hydraulics/Hydrology</u>	<u>Joseph Araujo</u>	
4. _____		

PRESENT DURING INSPECTION:

1. Mr. Stanley Galusza, Operations Manager, Chartpak Rotex Div.
2. _____
3. _____

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Chartpak Dam

DATE: 14 November 1979

EMBANKMENT: _____

CHECK LIST	CONDITION
<ol style="list-style-type: none"> 1. Upstream Slope <ol style="list-style-type: none"> a. Vegetation b. Sloughing or Erosion c. Rock Slope Protection - Riprap Failures d. Animal Burrows 2. Crest <ol style="list-style-type: none"> a. Vegetation b. Sloughing or Erosion c. Surface cracks d. Movement or Settlement 3. Downstream Slope <ol style="list-style-type: none"> a. Vegetation b. Sloughing or Erosion c. Surface cracks d. Animal Burrows e. Movement or Cracking near toe f. Unusual Embankment or Downstream Seepage g. Piping or Boils h. Foundation Drainage Features i. Toe Drains 4. General <ol style="list-style-type: none"> a. Lateral Movement b. Vertical Alignment c. Horizontal Alignment d. Condition at Abutments and at Structures e. Indications of Movement of Structural Items f. Trespassing g. Instrumentation Systems 	<p>There is no embankment. The dam is an overflow masonry structure which appears to span the entire width of the river channel. Abutments formed by vertical masonry retaining walls which parallel the river.</p> <p>The dam and abutment walls appear to be founded on ledge, consisting of granite and schist units with steeply dipping joints. The ledge rock appears relatively sound.</p> <p>There was no observed evidence of foundation movement. With the exception of some missing stones along the upper part of the dam. The masonry dam and abutment walls appears to be in generally good condition and in good alignment.</p> <p>Some seepage was noted at isolated places on the D/S face. There is vegetation growing between the stones.</p>

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Chartpak Dam

DATE: 14 November 1979

SPILLWAY: Entire Dam

BY: R. Wood

CHECK LIST	CONDITION
1. Approach Channel a. General Condition b. Obstructions c. Log Boom etc.	1.a. Good. b. Channel silted in. c. None observed.
2. Weir a. Flashboards b. Weir Elev. Control (Gate) c. Vegetation d. Seepage or Efflorescence e. Rust or Stains f. Cracks g. Condition of Joints h. Spalls, Voids Or Erosion i. Visible Reinforcement j. General Struct. Condition	2.a. None. b. None - top capstones gone for 75% of length, 2nd. course gone for 25% of length. c. Weeds in stone masonry joints. d. Three small pressure leaks. e. None observed. f. None observed. g. See c. h. None observed. See also 2b. i. N/A. j. Good except for missing stones.
3. Discharge Channel a. Apron b. Stilling Basin c. Channel Floor d. Vegetation e. Seepage f. Obstructions g. General Struct. Condition	3.a. None observed - may be natural ledge. b. None observed. c. Clear. d. Clear. e. Not visible. f. None observed. g. Good.
4. Walls a. Wall Location _____ (1) Vegetation (2) Seepage or Efflorescence (3) Rust or Stains (4) Cracks (5) Condition of Joints (6) Spalls, Voids or Erosion (7) Visible Reinforcement (8) General Struct. Condition	4.a. Wall ea. side are open jt. stone. masonry. Wall to left of weir is concrete capped (top & rear). (1) Top of walls (bushes) and weeds in some joints. (2) Seepage on left side indicated by D/S pool - appears to be left side wall. (3) Paint stain only (vandals). (4) In concrete cap left side. (5) Few missing stones. (6) See (5) (7) N/A. (8) Good.

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Chartpak Dam

DATE 14 November 1979

OUTLET WORKS: _____

BY: R. Wood

CHECK LIST	CONDITION
1. Inlet a. Obstructions b. Channel c. Structure d. Screens e. Stop Logs f. Gates	1. At face of dam - no obstruction.
2. Control Facility a. Structure b. Screens c. Stop Logs d. Gates e. Conduit f. Seepage or Leaks	2. Control gate removed.
3. Outlet a. Structure b. Erosion or Cavitation c. Obstructions d. Seepage or Leaks	3. Discharges at face of dam. Appears to be a tree trunk in conduit. Discharge onto ledge.
4. Mechanical and Electrical a. Crane Hoist b. Hydraulic System c. Service Power d. Emergency Power e. Lighting f. Lightning Protection	4. None.
5. Other	

APPENDIX B
ENGINEERING DATA

DOCUMENTS

List of Available Documents
Description of Dam by Mass. Division
of Waterways

Page No.

B-1
B-2 - 6

PRIOR INSPECTION REPORTS

<u>Date</u>	<u>By</u>	<u>Page No.</u>
August 1966	Hampshire County	B-7
April 30, 1968	Hampshire County	B-8 - 10
May 17, 1968	Hampshire County (letter)	B-11 - 12
June 6, 1968	Hampshire County	B-13 - 14
October 2, 1970	Hampshire County	B-15
October 29, 1970	Hampshire County	B-16
December 8, 1979	Mass. Div. of Waterways	B-17
June 7, 1971	Mass. Div. of Waterways	B-18
July 30, 1974	Mass. Div. of Waterways	B-19 - 23
August 18, 1976	Mass. Div. of Waterways	B-24 - 27

DRAWINGS

<u>No.</u>	<u>Title</u>	<u>Page No.</u>
1	Plan and Elevation Views of Dam	B-28

LIST OF DOCUMENTS
CHARTPAK DAM

ALL PERTINENT AVAILABLE DOCUMENTS ARE INCLUDED IN APPENDIX B

DESCRIPTION OF DAM

DISTRICT 2

Submitted by R. C. Salls, P.E. Dam No. 2-8-214-11
 Date July 30, 1974 City/~~Town~~ Northampton
 Name of Dam Starbuck Mfg. Company Dam

1. Location: Topo Sheet No. 11C Mass. Rect. Coordinates N 496,100 E 275,400
 Provide $8\frac{1}{2}$ " x 11" in clear copy of topo map with location of Dam clearly indicated.
On the Mill River in Leeds about 500' north of Mulberry Street Bridge.
2. Year built Unk Year/s of subsequent repairs Unk
3. Purpose of Dam: Water Supply _____ Recreational _____
 Flood Control _____ Irrigation _____ Other Old Mill Dam
4. Drainage Area: in excess of 30 _____ sq. mi. _____ acres.
 Type: City, Bus. & Ind. _____ Dense Res. _____ Suburban 5% Rural, Farm 20%
 Wood & Scrub Land 75% Slope: Steep 30% Med. 55% Slight 15%
5. Normal Ponding Area: 7 $\frac{1}{2}$ Acres; Ave. Depth 1 foot in river channel
 Impoundment: N/A gals.; _____ acre ft.
 Silted in: Yes X No _____ Approx. Amount Storage Area 80 - 90%
 Impoundment area silted in say 80 to 90%
6. No. and type of dwellings located adjacent to pond or reservoir _____
 i.e. summer homes etc. None immediately on pond.
7. Dimensions of Dam: Length 220' Max. Height 23' $\frac{1}{4}$ See Sketch
 Freeboard 4' from crest to top dam-as designed
 Slopes: Upstream Face 1:1
 Downstream Face Vertical - 1 on 4 batter on left end dam.
 Width across top 5' to 8'

Dam No. 2-8-214-11

8.

Classification of Dam by Material:

Earth _____ Conc. Masonry _____ Stone Masonry X
Timber _____ Rockfill _____ Other _____

8a.

Dam Type: Gravity X Straight X Curved, Arched _____ Other _____
Overflow X Non-overflow _____

9.

A. Description of present land usage downstream of dam:

75 % rural; 25 % ~~urban~~ developed

B. Is there a storage area or flood plain downstream of dam which could accommodate the impoundment in the event of a complete dam failure? Yes X No _____ below Country Club Dam

C. Character Downstream Valley: Narrow 30% Wide 70% Developed 25%
Rural 75% Urban _____

10.

Risk to life and property in event of complete failure.

No. of people 25+

No. of homes 25+

No. of businesses several

No. of industries 5 to 6 Type Diversified Plants
No. of utilities 5 Type Sewer, water, gas mains, electrical and telephone lines.

Railroads 0

Other dams 6 active dams

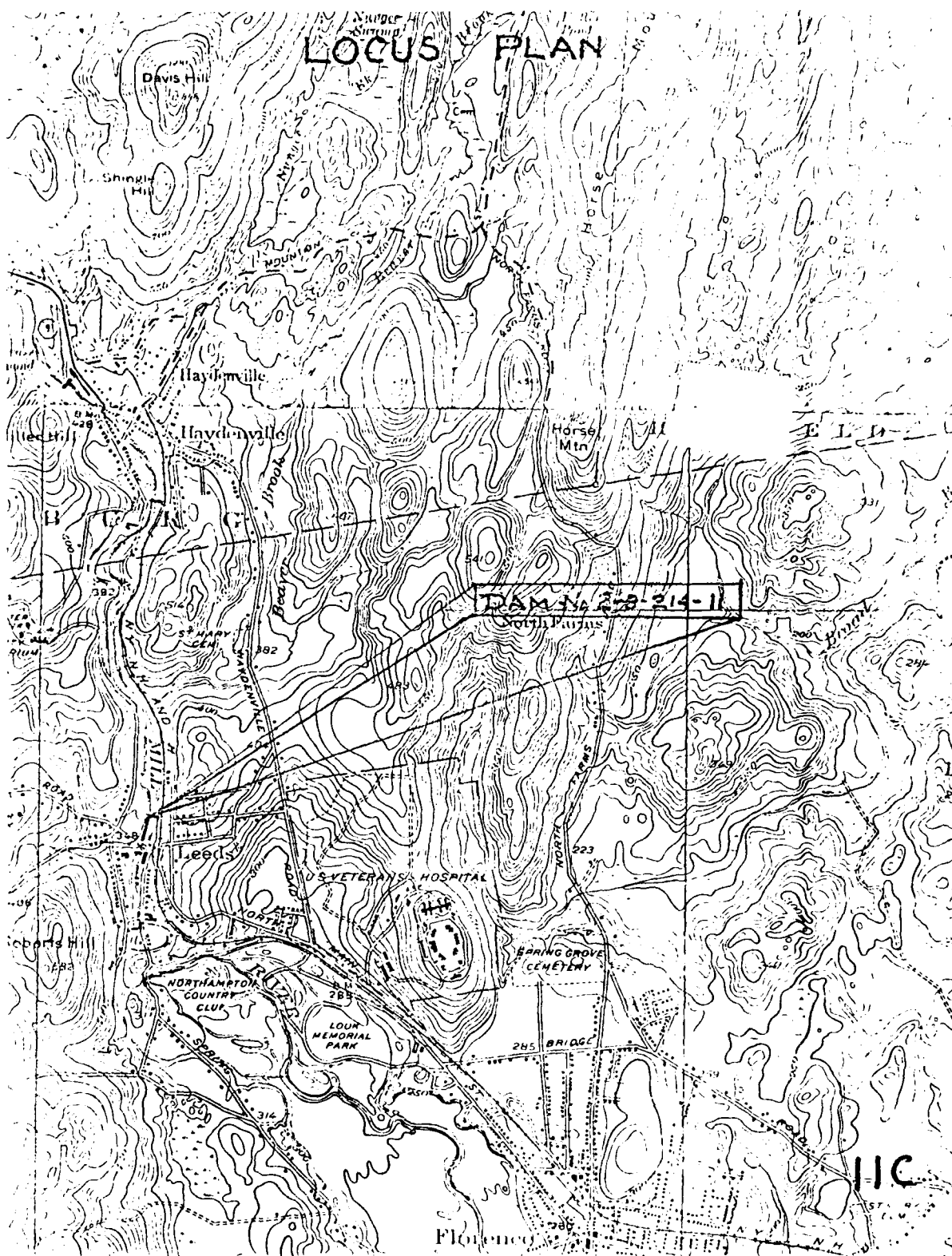
Other _____

Paradise Pond Dam No. 2-8-214-4
Clement Mfg. Co. Dam No. 2-8-214-5
Prophylactic Brush Co. Dam No. 2-8-214-6
Country Club Dam No. 2-8-214-18
Button Shop #1, Dam No. 2-8-214-9
Button Shop #2, Dam No. 2-8-214-10

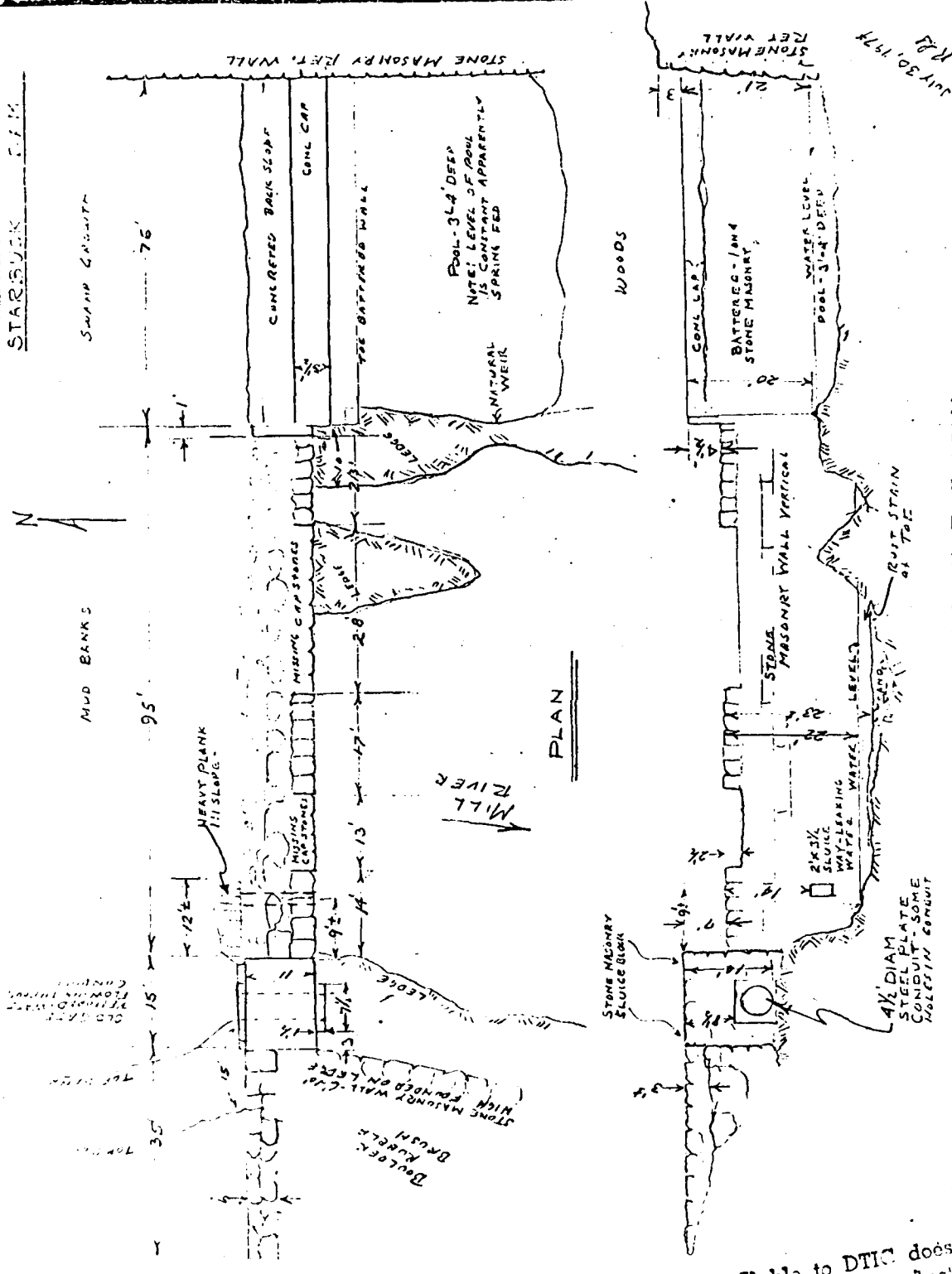
11.

Attach Sketch of dam to this form showing section and plan on 8 $\frac{1}{2}$ " x 11" sheet.

RCS/vk /rt
Attachments
Locus Plan
Sketches

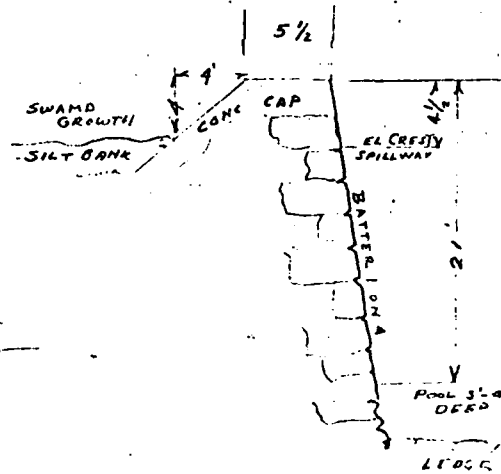
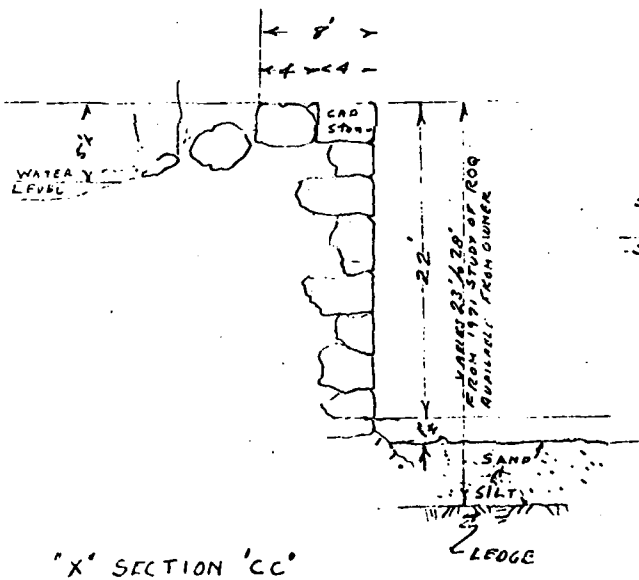
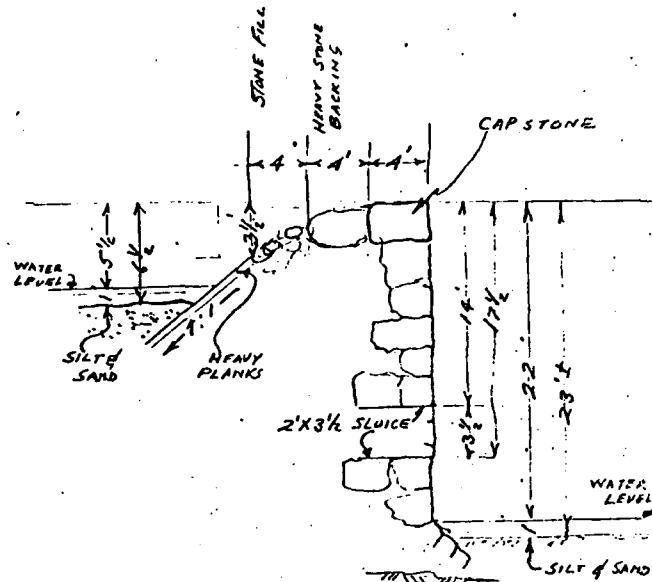
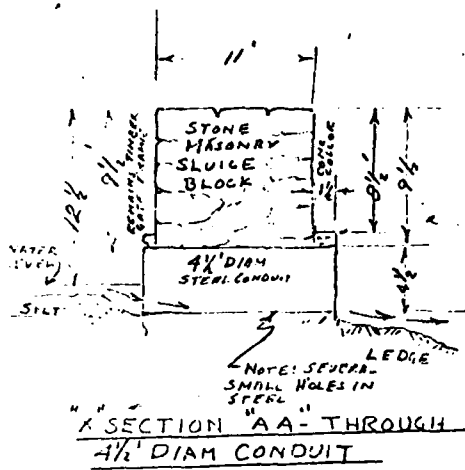


STARBUCK C.F.M.



DOWN STREAM ELEVATION

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JULY 30/74
H.S.

Tighe & Bond's Report - August, 1966:

Starbuck Manufacturing Company Dam

Two-thirds of the timber cap on the crest of the dam has now been washed away. Only the right one-third of this former timber cap remains. This remaining portion has been moved, apparently by ice action, and will probably be washed away in the near future.

The exposed stones now forming the crest of the dam present a rough top surface to the overflowing water and since they are not well jointed, it is possible that they will begin to be wasted away by flood flows and ice action. Once these stones begin to be dislodged, the dam masonry will begin to unravel and within a few years, a complete failure of the dam will be underway. If the owner intends to maintain the dam, measures should be taken soon to prevent any displacement of the stone blocks forming the crest of the dam.

Abutment masonry is in poor condition. The drawdown gate leaks and there are many individual leaks occurring through the joints of the stone masonry, particularly at the right downstream face of the dam. On the day of inspection, leakage equalled stream flow. Very little water was ponded. The greater part of the pond volume has been filled with sand, mud and gravel.

The only change that has taken place at this dam since the time of the last inspection is the further deterioration of the dam and the loss of an additional section of the timber crest cap. The owner should take steps to prevent further deterioration of the dam if the structure is to remain in tact and functional. Otherwise, the dam will begin to unravel in the near future and a complete failure will result. It is not expected that this failure will take place rapidly but will be progressive in nature as each high water season results in additional stones being displaced and washed away. Since the volume of the pond behind the dam is nearly filled with silt, mud and gravel, there will be no large volume of water to be released when the failure of the stone masonry wall of the dam begins to take place.

John H. Breguet, Chairman
Hampshire County Commissioners

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GEORGE H M DONNELL
PHILIP W SHERIDAN
EDWARD J BAYON

TIGHE & BOND

CONSULTING ENGINEERS

CIVIL SANITARY AND ELECTRICAL ENGINEERING
INVESTIGATIONS REPORTS PLANS AND SPECIFICATIONS
SUPERVISION OF CONSTRUCTION AND OPERATION

BOWERS AND PEQUOT STREETS
HOLYOKE MASSACHUSETTS
TELEPHONE 3 3991

CD Northampton
April 30, 1968

The Honorable the Board of County Commissioners
Hampshire County Courthouse
Northampton, Massachusetts

Re: Starbuck Mfg. Co. Dam
Leeds, Mass.

Gentlemen:

In accordance with your telephone request of Friday, April 26, 1968 relative to a problem at the above subject dam, Mr. Sheridan of our firm inspected the dam immediately and reported personally to the secretary in your office that there was no need to worry about the structure, and that a formal written report would be made to your Honorable Board.

The undersigned made a second inspection of the dam on Monday morning, April 29, 1968, and found that conditions as existing are in general, all in accordance with our prediction as contained in our report to your Board dated August 25, 1966, Page 7, Item "P". At that time, following my routine inspection of the dam, I reported to your Board as follows:

"Two-thirds of the timber cap on the crest of the dam has now been washed away. Only the right one-third of this former timber cap remains. This remaining portion has been moved, apparently by ice action, and will probably be washed away in the near future.

The exposed stones now forming the crest of the dam present a rough top surface to the overflowing water and since they are not well jointed, it is possible that they will begin to be washed away by flood flows and ice action. Once these stones begin to be dislodged, the dam masonry will begin to unravel and within a few years, a complete failure of the dam will be underway. If the owner intends to maintain the dam, measures should be taken soon to prevent any displacement of the stone blocks forming the crest of the dam.

**TIGHE
& BOND CONSULTING ENGINEERS**

-2-

Abutment masonry is in poor condition. The drawdown gate leaks and there are many individual leaks occurring through the joints of the stone masonry, particularly at the right downstream face of the dam. On the day of inspection, leakage equalled stream flow. Very little water was ponded. The greater part of the pond volume has been filled with sand, mud and gravel.

The only change that has taken place at this dam since the time of the last inspection is the further deterioration of the dam and the loss of an additional section of the timber crest cap. The owner should take steps to prevent further deterioration of the dam if the structure is to remain intact and functional. Otherwise, the dam will begin to unravel in the near future and a complete failure will result. It is not expected that this failure will take place rapidly, but will be progressive in nature as each high water season results in additional stones being displaced and washed away. Since the volume of the pond behind the dam is nearly filled with silt, mud and gravel, there will be no large volume of water to be released when the failure of the stone masonry wall of the dam begins to take place. "

As of the present time nearly all of the protective timber crest of this dam has rotted out and has been washed away. Only a small portion of the timber crest remains at the right side of the dam crest.

Loss of the timber crest has exposed the individual stones of the dam and, as predicted, the force of the overflowing water has dislodged some of the crest stones. Now that the individual masonry blocks are beginning to unravel, this action will continue, particularly as a result of each flood flow condition and the force of ice. The break in the crest of the dam will become wider and deeper and eventually, a complete failure will occur. Failure will be progressive and, in all probability, relatively slow.

Construction, filling and grading work is taking place along the right bank of the stream and in the vicinity of the right abutment of the dam as well as adjacent to the Chart-Pak plant. It is possible that the dam has changed ownership. According to the last records in this office, the mill building downstream of the dam in Leeds and the dam itself was owned by a Mr. Webster. In fact, a letter predicting the slow failure of this dam was addressed to Webster Mill in Leeds by your Honorable Board following the submission of my report in August, 1966.

-3-

**TIGHE
& BOND CONSULTING ENGINEERS**

In order to bring the records on this dam up-to-date, I am contacting various persons including the office of the Assessors of Northampton, to learn the name of the present owner of the dam.

The dam is readily visible from the main highway entering Leeds just downstream of the dam, particularly now that the right bank of the stream has been cleared, leveled and graded. Persons unfamiliar with the history of this dam and its construction may become alarmed over the loss of some of the stones. To allow the dam to remain in its present state may result in numerous calls for inspection from persons expressing concern over the old structure, particularly in time of flood flows.

Since the dam will, in all probability, never be used again for power or hydraulic purposes, it would seem best for all concerned to breach the structure. However, since in my opinion, the small quantity of water stored by the dam is not dangerous to persons and property downstream, it might be difficult to enforce an order to the owner for the breaching of the dam.

I feel that at the dam directly, there is greater danger to children who may play in the stream itself just below, on or above the dam. The dam as existing, might be classed an attractive nuisance. A child playing at or on the dam might cause additional stones to become dislodged or the stones may fall by themselves. Should this happen, a child could be seriously injured or killed.

In summary, it is my opinion that the dam does not require immediate action to safeguard persons and property downstream from a flood caused by the release of stored water. Any release of water will be slow and within the capacity limits of the stream bed below the dam. Conditions now existing and occurring at this dam are directly and exactly as predicted two years ago.

As soon as I am certain as to the legal owner of the dam, I will notify your Board in case you wish to advise or direct the owner to breach or repair the dam.

Respectfully submitted,
Tighe & Bond, Inc. -

George H. McDonnell
Chief Engineer

GHM/amd

GEORGE H. M. DONNELL
PHILIP W. SHERIDAN
EDWARD J. BAYON

**TIGHE
& BOND** CONSULTING ENGINEERS

CIVIL SANITARY AND ELECTRICAL ENGINEERING
INVESTIGATIONS REPORTS PLANS AND SPECIFICATIONS
SUPERVISION OF CONSTRUCTION AND OPERATION

BOWERS AND PEQUOT STREETS
HOLYOKE MASSACHUSETTS
TEL. WEEFERTON 3 3591

H-36 Northampton
May 17, 1968

The Honorable the Board of County Commissioners
Hampshire County Courthouse
Northampton, Massachusetts

Re: Starbuck Mfg. Co. Dam
Leeds, Mass.

Gentlemen:

To date, I have had no success in connection with determining the present owner of the above subject dam. No answer has been received from my letter sent to Chart-Pak, Inc. two weeks ago. I have now written to the Real Estate Agency listed as representing the owner of the mill building, hoping to learn whether or not the present mill building owner is also the owner of the dam.

If I have no success with this inquiry it will probably be necessary to trace ownership through the County Registry of Deeds.

The dam was examined again on May 15, 1968, and conditions had not changed materially, from those reported to your Board in my letter of April 30, 1968.

It can be expected that with each passing flood flow, additional stone blocks will be dislodged and the breach in the crest of the dam will become wider and deeper. Failure of additional timbers and planking will contribute to a widening and deepening of the breach.

I am still of the opinion that the structure as now existing, does not endanger persons and property downstream from a flood flow viewpoint, since very little water is stored by the dam and any failure of the dam

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-2-

will continue on a progressive basis with one stone block at a time being dislodged by either ice, debris or water action.

Very truly yours,

Tighe & Bond, Inc.

George H. McDonnell
Chief Engineer

GHM/amd
Encl.

GEORGE H. McDONNELL
PHILIP W. SHERIDAN
EDWARD J. BAYON

TIGHE & BOND

CONSULTING ENGINEERS

CIVIL, SANITARY AND ELECTRICAL ENGINEERING
INVESTIGATIONS, REPORTS, PLANS AND SPECIFICATIONS
SUPERVISION OF CONSTRUCTION AND OPERATION

BOWERS AND PEODOT STREETS
HOLYOKE, MASSACHUSETTS
TEL. JEFFERSON 3-3991

H-36 Northampton
June 6, 1968

The Honorable the Board of County Commissioners
Hampshire County Courthouse
Northampton, Massachusetts

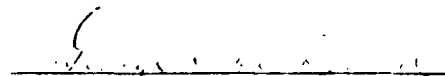
Gentlemen:

All of the dams situated within the City of Northampton have now been inspected at least once during the year 1968. Inspections have been made from time to time through the year and final inspections were made on Saturday, May 25, 1968.

Attached hereto is a detailed report showing the conditions noted at each dam within Northampton. The contents of the report are self-explanatory.

Respectfully submitted,

Tighe & Bond, Inc.


George H. McDonnell
Chief Engineer

GHM/amd
Encl.

June 6, 1968

-9-

P. Starbuck Manufacturing Company Dam

Special inspections of this dam were conducted in April as a result of a report that stone masonry at the crest of the dam was being washed away. Numerous reports regarding the condition of this dam have been filed since the time of the last routine inspection report. As of the present time, nearly all of the protective timber crest of this dam has rotted out or has been washed away. Only a small portion of the timber crest remains at the right side of the dam crest. Loss of the timber crest has exposed the individual stones of the dam and, as previously predicted, the force of the overflowing water has dislodged some of the crest stone. Now that individual masonry blocks are beginning to unravel, this action will continue, particularly as a result of each flood flow condition and the force of ice. The break in the crest of the dam will become wider and deeper. Eventually, a complete failure will occur. However, the failure will be progressive and, in all probability, relatively slow.

It is my opinion that the dam does not endanger persons and property downstream from a flow caused by release of stored water. Very little water is stored by the dam. The pond volume has been nearly filled completely with sand, gravel and debris washed down from above over the years by various flood flow conditions.

A detailed report on the conditions at this dam was sent to your Honorable Board on April 30, 1968.

Report of
High & Best
Oct 1970
1970

O. Starbuck Manufacturing Company Dam

1970 Inspection Report

A special report on the conditions observed at this dam was filed with your Board on March 16, 1970. Conditions are much the same as reported at that time except for further deterioration of the crest section of this stone dam. As of October 2nd, more stones have been dislodged from the crest. All crest timber construction is now gone. The face of the stone masonry leaks badly.

This dam will fail completely in the not too distant future and failure will probably occur during spring flood flow conditions much in the same manner that failure occurred at the Noble Dam located upstream. The Noble Dam failure occurred during the spring of the past year when

heavy flood flow conditions resulted from precipitation and large blocks of ice were being carried by the flood water.

The pond volume upstream of the dam has been nearly filled in with material washed down from upstream. As pointed out previously, very little water will be released when the dam fails, but once failure has occurred, Mill River will wash a valley through the sand, silt and gravel which now fills the old pond. This material will be carried downstream to be deposited in pools along the bed of Mill River as well as in the ponds formed by the downstream dams in the Leeds section of Northampton. These dams include the two Button Shop Dams and the Country Club Dam.

Changes have taken place at this dam since the time of the last inspection in that more of the crest stones and stone blocks of the dam itself have become dislodged. In the opinion of the undersigned, failure of the dam will progress and will eventually take place during heavy spring flood flow conditions either this coming spring or a near future spring.

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HAMPSHIRE COUNTY

NORTHAMPTON

Date of Inspection

Oct 29, 1970

NAME: Starbuck Dam

LOCATION: In Leeds Section of Northampton, 150 yds. upstream from
bridge over Mill River at Mulbury Street.

OWNER: Controversial -- Possible owners, Carpec Rotec Inc., adjacent
to Old Mill Location.

TYPE: Stone Masonry - Vertical drop spillway; approx. 18' high,
150' wide; spillway approx. 100' wide.

REMARKS & RECOMMENDATIONS: No repairs have been made since detailed in-
spection and report of Tighe & Bond made Oct. 2, 1970; if
no repairs can be made before spring thaw, the relief gate
should be opened, and left open until repairs are made to
the structure gate will probably have to be breached or
torn open as there is no evidence of operating equipment for
the 36" gate.

INSPECTED BY: M. Tenaglia

THE COMMONWEALTH OF MASSACHUSETTS

INTER OFFICE CORRESPONDENCE

DEPARTMENT OF PUBLIC WORKS

From Mason Tenaglia

DIVISION OF WATERWAYS

Attention of Mr. John T. Hannon, Deputy Chief Engr. December 8, 1970

Subject NORTHAMPTON:-Follow-up Inspection of Starbuck Dam, Leeds, Northampton

During a follow-up inspection of the Starbuck Dam in Leeds Northampton, it was noted that no work had been done to eliminate the danger the dam now possesses.

Leakage through the masonry stone blocks is more pronounced and it is my opinion that the structure will not survive the Spring floods.

Plant Operations Manager, Stanley M. Galusza, of Avery Products, discussed with me what repairs were needed in the event that the Company's Legal Department decides that Avery Products are the owners of the Starbuck Dam.

A search of the Registry of Deeds and City Assessors Office show that only Avery Products is the owner of land adjacent to, and West of the river, with appurtenances to the dam.

A letter received December 2, 1970, from Avery Products Corp., disclaimed ownership of the dam and stated that their Legal Department is looking into the matter. It is suggested at this time that the subject matter be referred to the Chief Counsel of the Department.

Respectfully submitted,

Mason Tenaglia
MASON TENAGLIA
Assistant Civil Engineer

MT/cmm

THE COMMONWEALTH OF MASSACHUSETTS

INTER OFFICE CORRESPONDENCE

DEPARTMENT OF PUBLIC WORKS

From MASON TENAGLIA

DIVISION OF WATERWAYS

EDWARD CHASE,

Attention of ACTING DEPUTY CHIEF ENGR.

June 7, 1971

Subject NORTHAMPTON - STARBUCK DAM - LEEDS

Met with Ellsworth Buckman, Engineer from District 2; Robert Fisher of O'Connell Construction Co. and current plant manager for Avery Products Co., Avery Products Co. being the owner of record of the Starbuck Dam.

The existing inoperable gate was broken open and water now rushes through the 36" pipe. This resulted in a new channel in the stream, and the sand and silt which had built up behind the dam is slowly eroding and being washed downstream.

Mr. Fisher and the Avery Plant Manager wanted my approval for one of the various methods of either repairing or partially dismantling of the Dam.

I have given Mr. Fisher several form applications for authorization to repair or rebuild a Dam or Reservoir. Mr. Fisher was reminded that a registered Professional Engineer would have to affix his stamp and signature to whatever plans are submitted.

Respectfully submitted,

Mason Tenaglia
MASON TENAGLIA
Assistant Civil Engineer

EC

MT:hlb

Insp on June 3, 1971

INSPECTION REPORT - DAMS AND RESERVOIRS

1. LOCATION:

City/Town Northampton County Hampshire Dam No. 2-8-214-11

Name of Dam Starbuck Dam

Mass. Rect.

Topo Sheet No. 11C Coordinates: N 496,100 E 275,400

Inspected by: R. C. Salls, P.E. On July 30, 1974 Date 6/7/71 Last Inspection

2. OWNER/S: As of November 9, 1972

per: Assessors X Reg. of Deeds _____, Plav. Insp. _____, Per. Contact X

1. Avery Products Corp. 415 Huntington Drive, San Marino, California 91108
Name _____ St. & No. _____ City/Town _____ State _____ Tel. No. _____

2. _____
Name _____ St. & No. _____ City/Town _____ State _____ Tel. No. _____

3. _____
Name _____ St. & No. _____ City/Town _____ State _____ Tel. No. _____

3. CARETAKER: (if any) e.g. superintendent, plant manager, appointed by absentee owner, appointed by multi owners.

Operations Manager of Chartpak Rotex
Stanley H. Galusza
Name _____ St. & No. _____ City/Town Leeds State Mass. Tel. No. 01053 413-584-5446

4. DATA: 1970 pictures

No. of Pictures Taken available Sketches See description of Dam.
Plans, Where in Boston files 1972 sketch plans in owner possession

5. DEGREE OF HAZARD: (if dam should fail completely)*

1. Minor X
2. Moderate _____
3. Severe _____
4. Disastrous _____

Comments: Pool silted up approx. 80 - 90% of impoundment area.

--*This rating may change as land use changes (future development).

⑥ OUTLETS: OUTLET CONTROLS AND DRAWDOWN

No. 1 Location and Type: Right end dam - 4 1/2' dia. steel plate conduit pipe draw-
down.

Controls yes, TYPE: Wood slidegate - (gate gone holding frame badly
deteriorated)

Automatic . Manual X. Operative Yes , No X.

Comments: All evidence of controls and gate itself were missing at time of
inspection.

No. 2 Location and Type: 95' wide 4 1/2" dropwall spillway drop 22' center structure

Controls No, Type: .

Automatic . Manual . Operative Yes , No .

Comments: Several crest stone blocks are missing for one layer down.

No. 3 Location and Type: 59'± out from right end dam - 14' down from crest of over-
flow spillway a 3 1/2' H. x 2' W. stone masonry mud sluice.

Controls yes, Type: Unk - no controls visible - upstream end buried in
silt.

Automatic . Manual . Operative Yes , No .

Comments: It was noted that water was leaking out of downstream end of
sluiceway.

Drawdown present Yes X, No . Operative Yes X, No .

Comments: See Item No. 1 above - draw down completely open at time of inspection.
Water flowing through mud bank in former pond bottom.

⑦ DAM UPSTREAM FACE: Slope 1:1, Depth Water at Dam 1'± in river
channel

Material: Turf . Brush & Trees . Rock fill . Stone
Masonry X. Wood .

Other Left end of dam concrete capped - See Sketches.

Condition: 1. Good . 3. Major Repairs X.

2. Minor Repairs . 4. Urgent Repairs .

Comments: Pond is completely drawn down to normal river flow - Many stones missing
from crest of center spillway - 95' W. x 4 1/2' H. draw down sluice wide.
open and is kept this way constantly.

⑧ DAM DOWNSTREAM FACE: Slope Vertical: 1' on 4'
batter on left end dam.

Material: Turf . Brush & Trees . Rock Fill . Stone
Masonry X. Wood .

Other .

Condition: 1. Good . 3. Major Repairs X.

2. Minor Repairs . 4. Urgent Repairs .

Comments: Stone masonry in downstream face of dam appear stable. However, many
blocks are missing from crest and others on top appear loose.

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9. EMERGENCY SPILLWAY: Available No . Needed No .

Height Above Normal Water _____ Ft.

Width _____ Ft. Height _____ Ft. Material _____

Condition: 1. Good _____ 3. Major Repairs _____

2. Minor Repairs _____ 4. Urgent Repairs _____

Comments: Entire width of dam would serve as an overflow spillway in high
water levels.

10. WATER LEVEL AT TIME OF INSPECTION: $5\pm$ Ft. Above _____. Below X _____.

Top Dam _____ F.L. Principal Spillway X - Holes created by missing stones
from crest of dam are only $2\frac{1}{2}$ ' above water level.

Other _____

Normal Freeboard $4\frac{1}{2}$ Ft. crest spillway to top dam as designed.

11. SUMMARY OF DEFICIENCIES NOTED:

Growth (Trees and Brush) on Embankment Minor growth in cracks in stone masonry _____

Animal Burrows and Washouts No _____

Damage to Slopes or Top of Dam Yes, cap stones missing over 43% spillway width.
Weather cap gone from sluice block.

Cracked or Damaged Masonry Yes see above _____

Evidence of Seepage At toe of dropwall adjacent to second ledge outcropping
from left end dam. Noticeable rust stain.

Evidence of Piping N/A _____

Leaks Through mud sluice 59' from right end dam. _____

Erosion See Above _____

Trash and/or Debris Impeding Flow Not at time of inspection. _____

Clogged or Blocked Spillway _____

Other _____

12.

OVERALL CONDITION:

1. Safe_____.
 2. Minor repairs needed_____.
 3. Conditionally safe - major repairs needed_____.
 4. Unsafe_____.
 5. Reservoir impoundment no longer exists (explain) X
- Recommend removal from inspection list Removal from inspection list not
recommended.

13.

REMARKS AND RECOMMENDATIONS: (Fully Explain)

This unused old stone masonry dam was viewed with Mr. Stanley Galusza, Operating Manager of Chartpak Rotex Division of Avery Products Corporation. Owner, Mr. Galusza was able to supply us with a recent plan prepared in 1971 which showed ledge elevations along the toe of the dam. These were used to estimate the depths of ledge shown on our sketches. Also, he supplied us with a copy of a resume of the condition of the dam prepared on August 21, 1972 by Tighe and Bond, Consulting Engineers.

At the time of our inspection there was almost no impoundment and the Mill River was flowing through mud banks in the bottom of the former pond into the 4½ foot diameter conduit through the sluice block on the west or right end of the overflow spillway. The gate on the upstream end of this conduit has been completely removed. Mr. Galusza said that occasionally rubbish is cleared from the conduit to prevent blockage. Just upstream of the conduit the silt deposits are a foot above the conduit's flow line. The Steel liner plate of the conduit appears to have several holes in it.

The original overflow spillway's crest had a timber and plank cover over the stone masonry. Presently only traces of this remain and flood water has dislodged some of the massive cap stones creating gaps in the crest and allowing some of the backing stones to become displaced. Under flood conditions when water flows over the old spillway unraveling of the stone masonry would continue. Since the conduit on the right end is now open continuously such conditions should be less frequent.

13. REMARKS AND RECOMMENDATIONS (Continued)

In the event of a blockage of the conduit and a refilling of the pond, there would be very little impoundment since the old pond area has been filled with silt and sand for about 80 to 90% of its capacity.

There is a 2' W. x 3½' H. rectangular sluiceway near the west end of the overflow spillway about 17½ below the spillway's crest. This was leaking quite a sizeable flow of water. The upstream end was not visible and the silt deposit over it was from 10 to 12 feet deep.

The downstream face of the spillway dropwall is built of cut stone blocks fitted closely together without mortar. When water is impounded leakage will occur through these joints unless there is an impervious core behind the wall.

At the toe of the dropwall immediately to the right of the westerly ledge outcropping there is a prominent rust stain which could indicate some leakage near the base of the wall.

The easterly end of the dam or emergency overflow spillway is a mortared stone wall with a concrete cap 4½ feet higher than the main spillway. The deposits of silt and sand behind it are well above the elevation of the gaps in the main spillway crest and there is a growth of brush and swamp vegetation on it. At the toe of this wall retained on the west side by a ledge ridge there is a pool of water with a continuous flow from this pool over a natural weir into the downstream thread of the Mill River. Local people said that this pool is always full even in dry weather. This appears to be a spring fed pool unconnected with the dam.

The stone retaining wall on the east end of the dam which runs north and south along the shore of the Mill River was apparently built to retain the roadbed of a railroad which has been abandoned for many years.

It is quite apparent that the deterioration of this structure will continue but at a lesser rate now that the normal flow is routed through the conduit. The action of ice and of the growth of brush and other plants in the joint of the stone masonry will slowly destroy the entire structure over a period of time.

RCS/rt

INSPECTION REPORT - DAMS AND RESERVOIRS

1. LOCATION:

City/Town Northampton County Massachusetts Dam No. 2-2-214-11

Name of Dam Starbuck Mfg. Co. Dam

Topo Sheet No. 11C Coordinates: N 456,100, E 275,400

Inspected by: Harold L. Sawyer, On August 18, 1976 Date 7-30-76 Last Inspection

2. OWNER/S: As of August 18, 1976

per: Assessors _____, Reg. of Deeds _____, Prev. Insp. X, Per. Contact X

1. Ivy Products Corp., 415 Huntington Drive, San Marino, Cal. 91108
Name St. & No. City/Town State Tel. No.

2. _____
Name St. & No. City/Town State Tel. No.

3. _____
Name St. & No. City/Town State Tel. No.

3. CARETAKER: (if any) e.g. superintendent, plant manager, appointed by absentee owner, appointed by multi owners.

Mr. Stanley A. Galusza,
Operations Manager of Chertock Corp., Leeds, Mass. 01053
Name St. & No. City/Town State Tel. No.

4. DATA: 1970 pictures:

No. of Pictures Taken available Sketches See description of Dam.
Plans, Where in Boston files

1972 sketch plans in owner's possession.

5. DEGREE OF HAZARD: (if dam should fail completely)*

1. Minor X
2. Moderate _____
3. Severe _____
4. Disastrous _____

Comments: Roll silted in-up to 85-90% of impoundment area.

*This rating may change as land use changes (future development).

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⑥ OUTLETS: OUTLET CONTROLS AND DRAWDOWN

No. 1 Location and Type: West end of dam - 4' dia. steel plate conduit.

Controls Yes, TYPE: Wood slide gate

Automatic . Manual X. Operative Yes , No X.

Comments: Gate and controls removed - Conduit blocked with debris.

No. 2 Location and Type: At dam - stone masonry spillway, 95' wide x 7' high
with a stone masonry dropwall 22' high.

Controls None, Type:

Automatic . Manual . Operative Yes , No .

Comments: Several of crest stone blocks, plus several blocks of next course
are missing. 59' out from west end of dam - 14' down from crest.

No. 3 Location and Type: of spillway - 3' dia. x 2' w. stone masonry and sluice.

Controls Yes, Type: Unk. - no controls visible - upstream end buried in silt.

Automatic . Manual . Operative Yes , No .

Comments: Large leakage noted at downstream end of sluice way.

Drawdown present Yes X, No . Operative Yes X, No .

Comments: See item 1 above - conduit partly plugged by debris - gate and controls
removed.

⑦ DAM UPSTREAM FACE: Slope 1:1, Depth Water at Dam 1' to 6'

Material: Turf . Brush & Trees . Rock fill . ^{Stone} Masonry X. Wood .

Other Last end of dam concrete canceled.

Condition: 1. Good . 3. Major Repairs X.

2. Minor Repairs . 4. Urgent Repairs .

Comments: In pondment was increased somewhat by debris plugged drawdown conduit -
approx. 500 thousand gallons.

⑧ Vertical

DAM DOWNSTREAM FACE: Slope 1' on 4' latter on east end of dam.

Material: Turf . Brush & Trees . Rock Fill . ^{Stone} Masonry X. Wood .

Other

Condition: 1. Good . 3. Major Repairs X.

2. Minor Repairs . 4. Urgent Repairs .

Comments: Stone masonry of dropwall face appears stable - crest of dam is
continuing to unravel - three courses deep in some areas.

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 contain fully classified information

9. EMERGENCY SPILLWAY: Available no. Needed no.

Height Above Normal Water: _____ Ft.

Width _____ Ft. Height _____ Ft. Material _____.

Condition: 1. Good _____ 3. Major Repairs _____.

2. Minor Repairs _____ 4. Urgent Repairs _____.

Comments: Entire width of dam would serve as overflow spillway in high water level

10. WATER LEVEL AT TIME OF INSPECTION: 24 Ft. Above _____ Below _____.

Top Dam _____ P.L. Principal Spillway Water flowing through holes
in crest of spillway formed by missing stones.

Other _____

Normal Freeboard 4 1/2 Ft. from crest of spillway to top of dam as designed

11. SUMMARY OF DEFICIENCIES NOTED:

Growth (Trees and Brush) on Embankment Minor growth

Animal Burrows and Washouts None found

Capstones missing over 50% of spillway width
Damage to Slopes or Top of Dam weather cap gone from sluice block.

Cracked or Damaged Masonry Yes-see above

Evidence of Seepage Several areas of seepage

Evidence of Piping None found

Leaks Through mud sluice near west end of dam.

Erosion None found

Trash and/or Debris Impeding Flow Yes-drawdown conduit blocked with debris.

Clogged or Blocked Spillway Yes-see above

Other Spillway crest still slowly deteriorating by crest stones becoming displaced

(12.)

OVERALL CONDITION:

1. Safe _____.
2. Minor repairs needed _____.
3. Conditionally safe - major repairs needed _____.
4. Unsafe X _____.
5. Reservoir impoundment no longer exists (explain)
Recommend removal from inspection list _____.

(13.)

REMARKS AND RECOMMENDATIONS: (Fully Explain)

This is an old stone masonry dam which has been slowly deteriorating over the years. A large percentage of the spillway crest capstones are missing and in some areas the second and even a few of the third course stones are displaced. (These displaced stones lay in the river bed at downstream toe of dam.)

An impoundment of approximately 2 million gallons of water existed on the day of inspection. This impoundment appears to be due to the blockage of the drawdown conduit by driftwood and other debris. At time of last inspection on 7-30-74 this conduit was open and free of any debris and only the normal river flow existed in the bottom of the pond. Most of the river flow at this present inspection was passing through the cavities in the spillway crest caused by displaced stone masonry blocks.

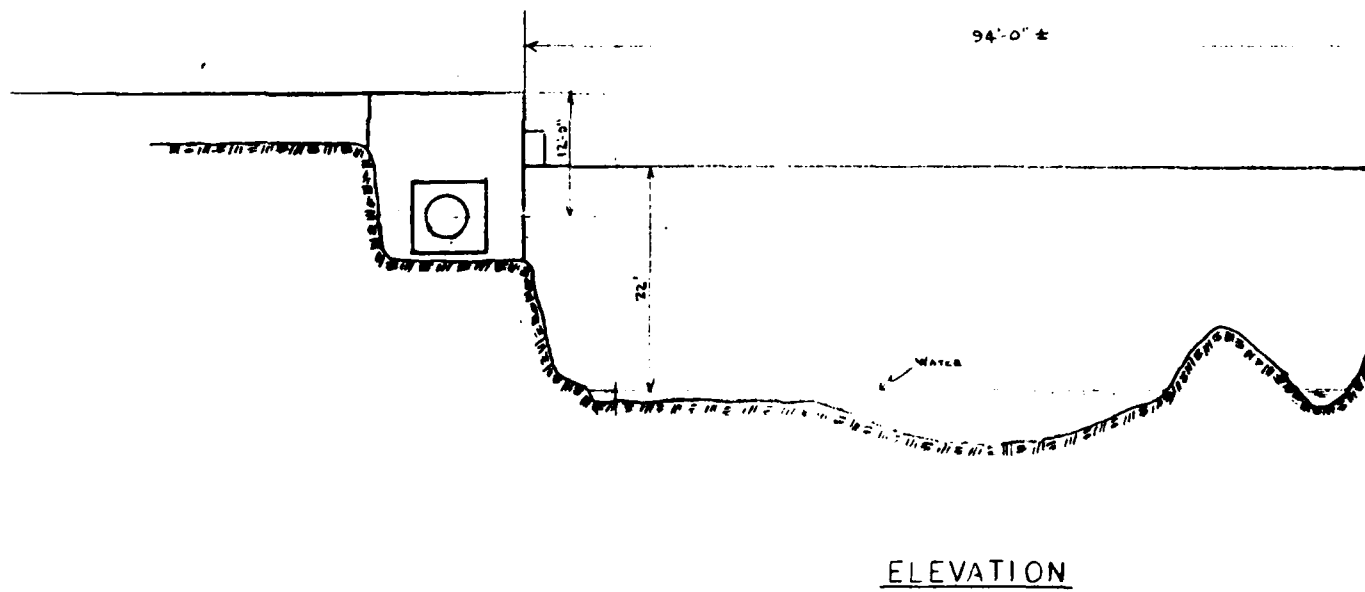
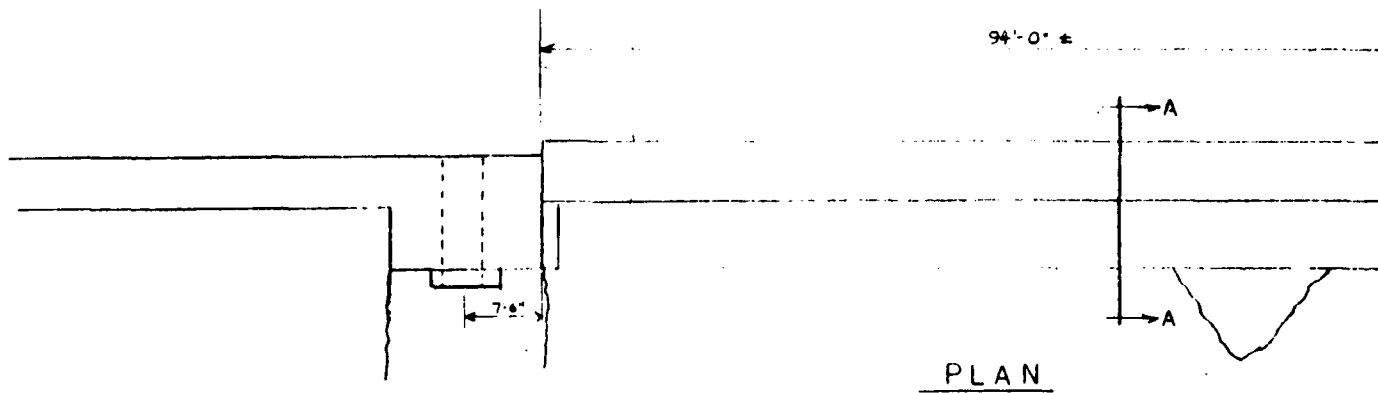
The blocked drawdown conduit condition was brought to Mr. Stanley Galusza's attention immediately after the inspection tour was made. Mr. Galusza stated he would have the problem corrected immediately. Removal of the debris from the conduit would reduce the present impoundment to zero and thereby reduce the hazard of dam's sudden failure.

It would appear that under flood conditions this dam will continue to unravel along the spillway and will probably eventually fail completely in some future flood.

The District recommends that owners be requested to constantly check the drawdown pipe and keep same free of any and all debris. This would allow normal river flow to pass freely through pipe and prevent recurrence of present impoundment condition.

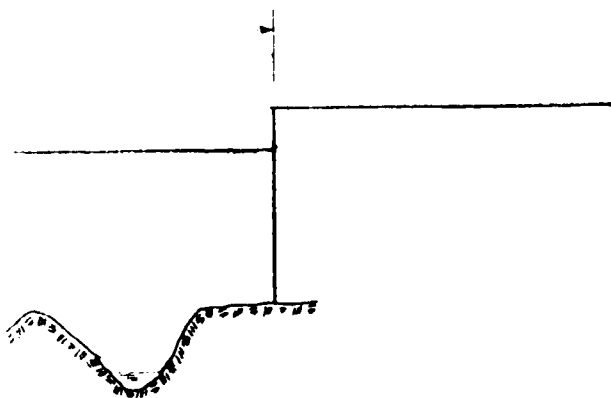
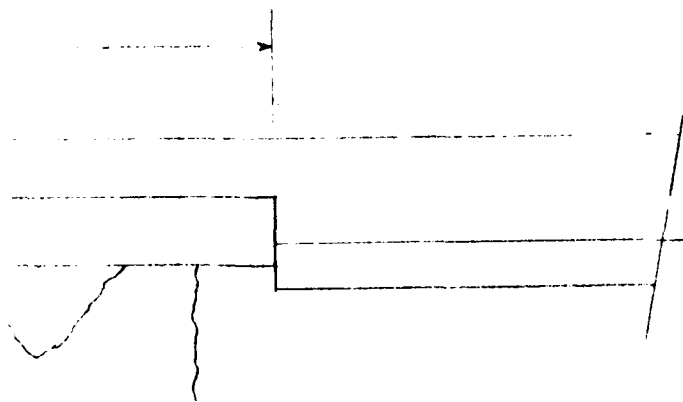
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JTs/ds

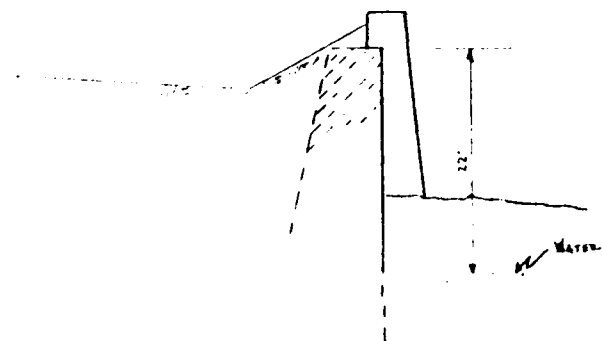


1073

DANIEL O'CONNELL'S SONS
GENERAL CONTRACTORS
480 HAMPDEN STREET
HOLYOKE, MASS. 01010



SCALE 1"=10'



SECTION A-A

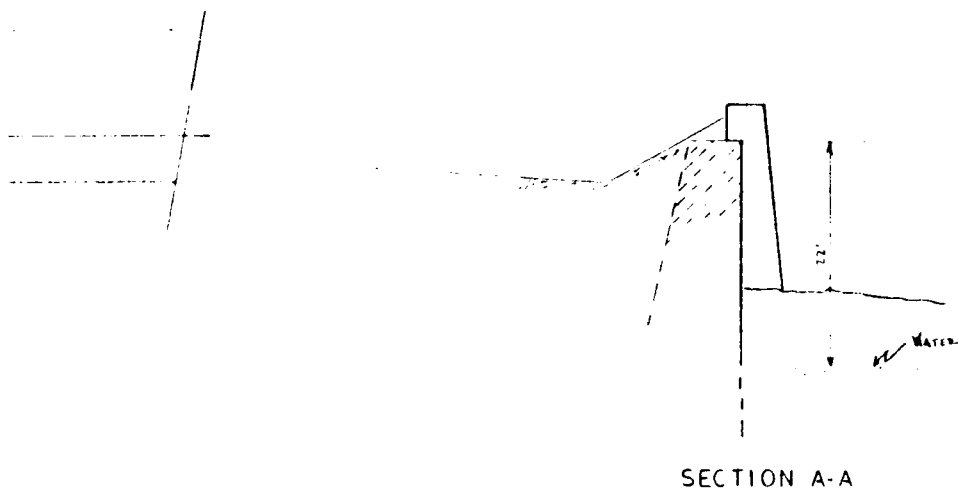
DAM
CHARTIAR ROTEX
LEEDS, MASS

6-7-71
RCC

243

APPENDIX

DANIEL O'CONNELL'S SONS, INC.
GENERAL CONTRACTORS
480 HAMPDEN STREET
HOLYOKE, MASS. 01010



SCALE 1"=10'

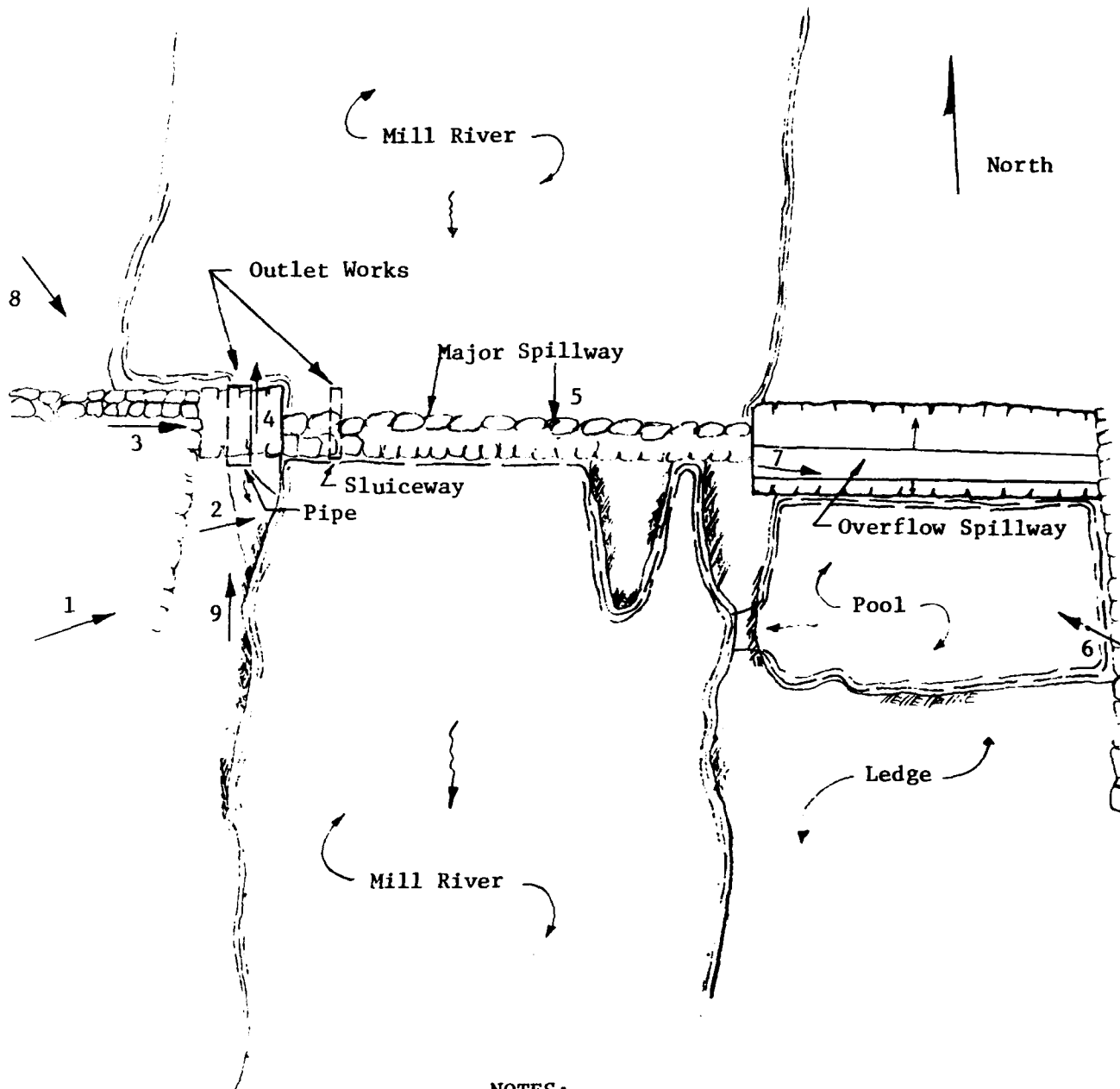
DAM
CHARTERED ROTEX
LEEDS, MASS

6-7-71
RLO

APPENDIX B

APPENDIX C
PHOTOGRAPHS

<u>LOCATION PLAN</u>		<u>Page No.</u>
Location of Photographs		C-1
<u>PHOTOGRAPHS</u>		<u>Page No.</u>
<u>No.</u>	<u>Title</u>	
1	Overview of Dam.	iv
2	View of Dam from Downstream.	C-2
3	Spillway Crest.	C-2
4	View of Upstream Channel.	C-3
5	View of Downstream Channel.	C-3
6	View of Downstream Face of Dam.	C-4
7	View of Downstream Stone Masonry Wall.	C-4
8	Upstream Face of Dam near Right Abutment.	C-5
9	Downstream Face of Dam near Right Abutment Showing Outlet Works.	C-5



NOTES:

1. PLAN BASED ON 30 JULY 1974 MASS. DPW SKETCH AND CDM FIELD OBSERVATIONS.
2. 1 DENOTES PHOTOGRAPH NUMBER AND DIRECTION OF VIEW.

CAMP DRESSER & MCKEE, INC.
BOSTON, MASSACHUSETTS

U.S. ARMY ENG. DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MA.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCATION OF PHOTOGRAPHS

CHARTPAK DAM

NORTHAMPTON, MASSACHUSETTS

Scale: Not To Scale

Date: December, 1979

APPENDIX C-1



2. VIEW OF DAM FROM DOWNSTREAM



3. SPILLWAY CREST.

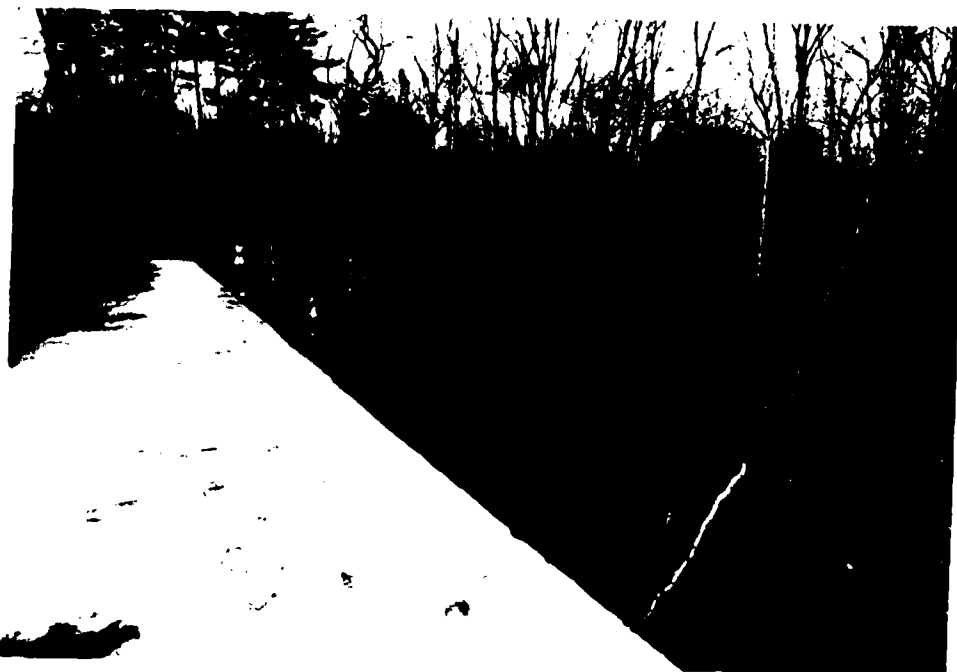


ATION





6. VIEW OF DOWNSTREAM FACE OF DAM FROM LEFT ABUTMENT



7. VIEW OF DOWNSTREAM FACE OF DAM FROM RIGHT ABUTMENT



8. UPSTREAM FACE OF DAM NEAR RIGHT ABUTMENT



9 DOWNSTREAM FACE OF DAM NEAR RIGHT ABUTMENT SHOWING OUTLET WORKS

APPENDIX D

HYDRAULIC AND HYDROLOGIC COMPUTATIONS

Page No.

FIGURES

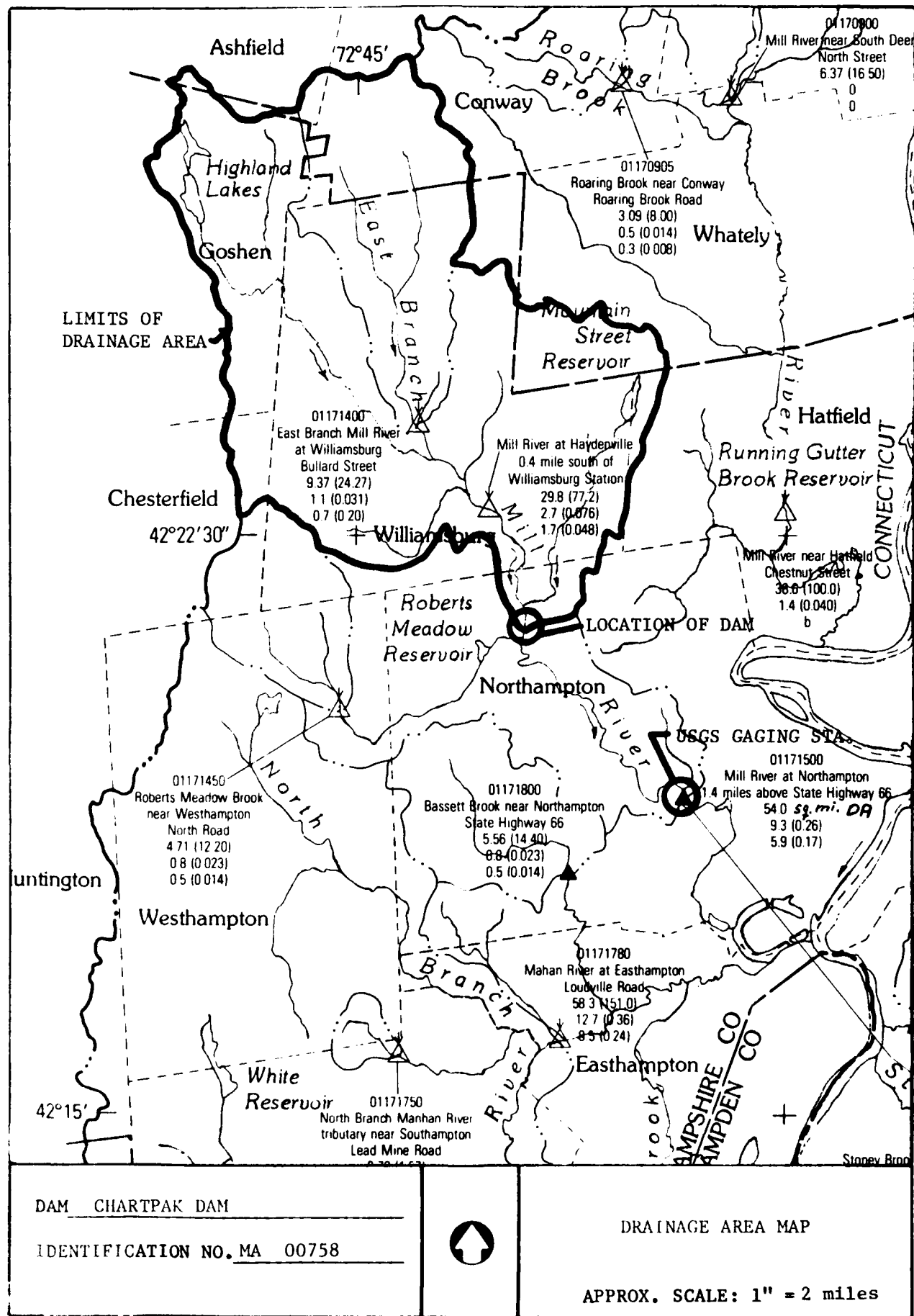
Drainage Area Map
Dam Failure Impact Area Map

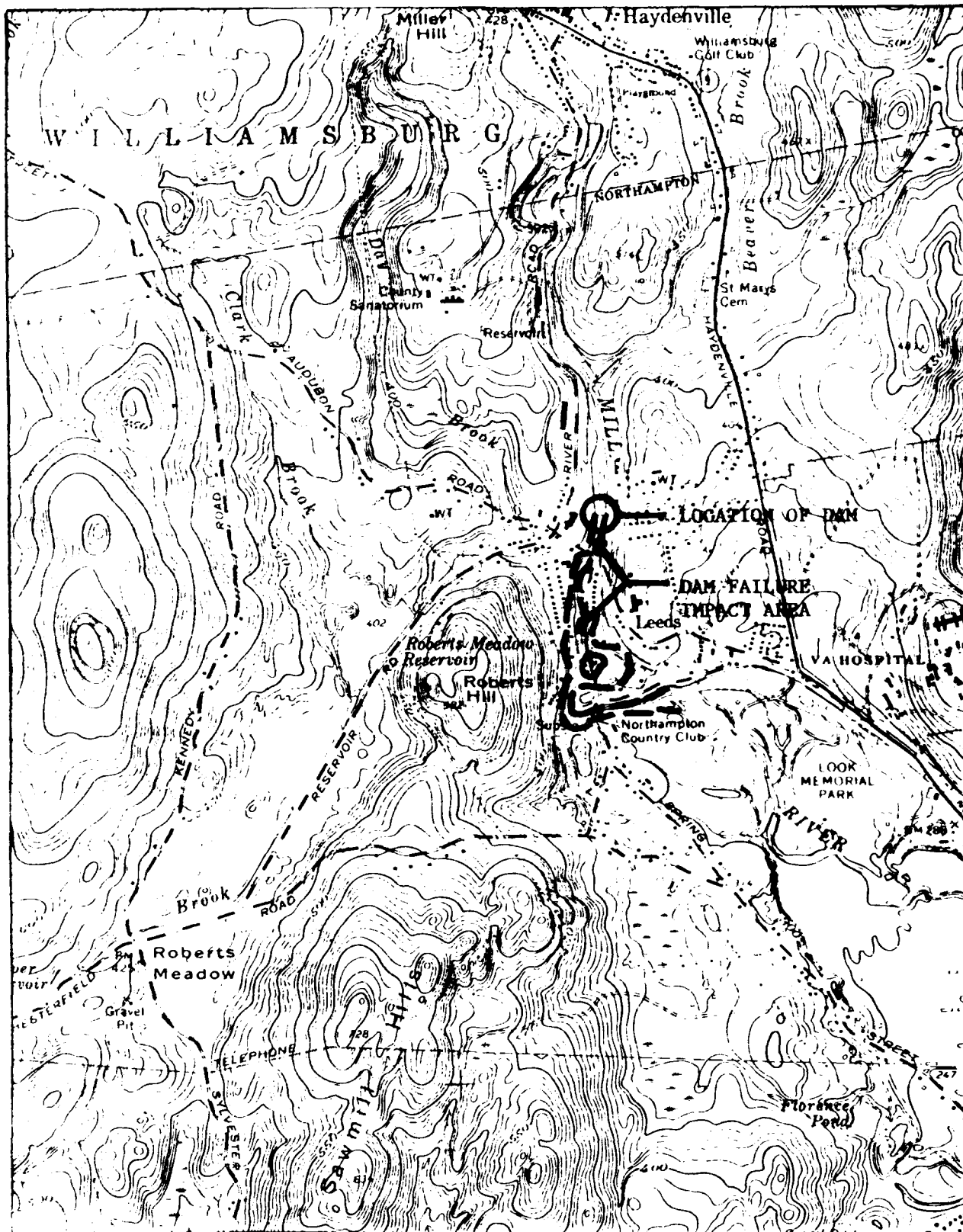
D-1
D-2

COMPUTATIONS

Test Flood Development
Discharge and Storage Capacities
Storage Routing
Tailwater Analysis
Dam Failure Analysis

D-3 & D-4
D-5 thru D-6
D-7
D-8
D-9 thru D-14





DAM CHARTPAK DAM

IDENTIFICATION NO. MA 00758



DAM FAILURE IMPACT AREA MAP
USGS QUADRANGLE

EASTHAMPTON, MA

APPROX. SCALE: 1" = 2000'

ELEVATIONS

Elevations based on NGV Datum as used in the Flood Insurance Study by the U.S. Army Corps of Engineers, N.E.D. for the City of Northampton.

Original Spillway Crest 355.7.

At the time of this study, only about 25% of the spillway length still had the original spillway capstones and a spillway crest El. of 355.7. About 50% of the spillway length had one course of bricks missing and a spillway crest El. of 353.2. The remainder of the spillway length had two brick courses missing and a spillway crest El. of 350.7.

Top of Dam 363.0

Toe of Dam 332 ±

SURFACE AREAS

Drainage Area to Dam = D.A. to USGS Gaging Sta. D/s
minus intervening area
= 54.0 - 13.8
= 40.2 square miles

Estimated Pool Surface Areas:

@ elev. 350.7 (lowest spillway crest) ≈ 5.5 acres
@ elev. 360.0 ≈ 14.5 acres
@ elev. 370.0 ≈ 39.5 acres

STORAGE

@ Lowest Spillway Crest, Storage = 5.5 x 1 = 5.5 acre-feet

@ El. 360.0, Storage = 5.5 + ((5.5 + 14.5)/2) 9.3 = 99 ac-ft

@ El. 370.0, Storage = 99 + ((14.5 + 39.5)/2) 10 = 369 ac-ft

Storage @ top of Dam (El. 363.0):

99 + ((14.5 + 39.5)/2) 3 = 180 acre-feet

TEST FLOOD DETERMINATION

The dam size is "small" based on a height of about 31 ft and a storage of 180 acre-feet.

Based on the dam failure analysis, the hazard is "high". Therefore, based on the NED Corps of Engineers Guidelines, the test flood range for Chartpak is

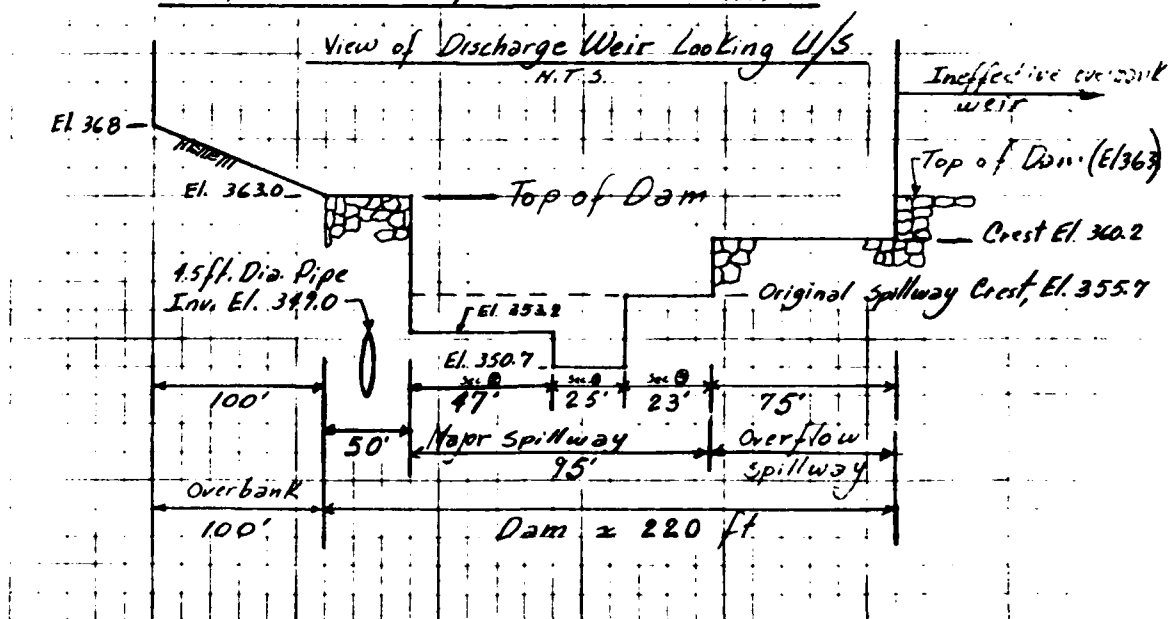
Test Flood $\approx \frac{1}{2}$ PMF to a PMF; use the $\frac{1}{2}$ PMF

The drainage area is generally "rolling" to "mountainous" with some storage along Beaver Brook which is located to the east bank of the Mill River. Base the test flood on the "rolling" curve developed by the NED Corps of Engineers "Preliminary Guidance for Estimating Max. Probable Discharge in Phase I Dam Safety Investigations." March 1978.

$$\therefore \text{Peak Tot Flood Inflow} = 625 \text{ cfs/mi}^2 \times 40.2 \text{ sq. mi} = 25,125$$

say 25,100 cfs

STAGE-DISCHARGE RELATIONSHIP



STAGE-DISCHARGE RELATIONSHIP

Upstream W.S. EL. (NGVD)	MAJOR Spillway Discharge			Wet Conduit Overflow Spilling Discharge Over Rt. Abutment			Total Project Discharge (cfs)
	Section ① Crest El. 350.7 Length = 25' Crest El. 353.2 Length = 47'	Section ② Crest El. 353.2 Length = 23'	Section ③ Crest El. 353.7 Length = 15 ft	Discharge Crest El. 360.2 Length = 95'	Discharge Crest El. 363.0 Length = 50'	Discharge Crest El. 363.0 Length = 100 ft	
	C. Qs1	C. Qs2	C. Qs3	H. Qc	C. Qc	C. Qc	
350.7	2010	—	—	1.0	45	—	45
353.2	2.9	286	—	2.1	135	—	421
355.7	3.1	866	29	4.5	209	—	1614
357.7	3.25	1505	3.1	1391	2.9	189	3,329
360.2	3.4	2489	3.2	2785	3.1	681	6,242
361.7	3.5	3192	3.4	3960	3.2	1082	8,930
363.7	3.6	4218	3.5	5597	3.4	1769	13,479
365.7	3.65	5301	3.6	7478	3.5	2546	19,507
367.7	3.7	6484	3.65	9472	3.6	3442	27,110

Spillway and Outlet Works Discharge @ top of dam elevation 363.0:

$$Q_T = Q_{\text{major spillway}} + Q_{\text{outlet works}} + Q_{\text{pipe}} = 10,415 + 1,100 + 335 = 11,850 \text{ cfs}$$

... @ Test Flood Elevation 371.1:

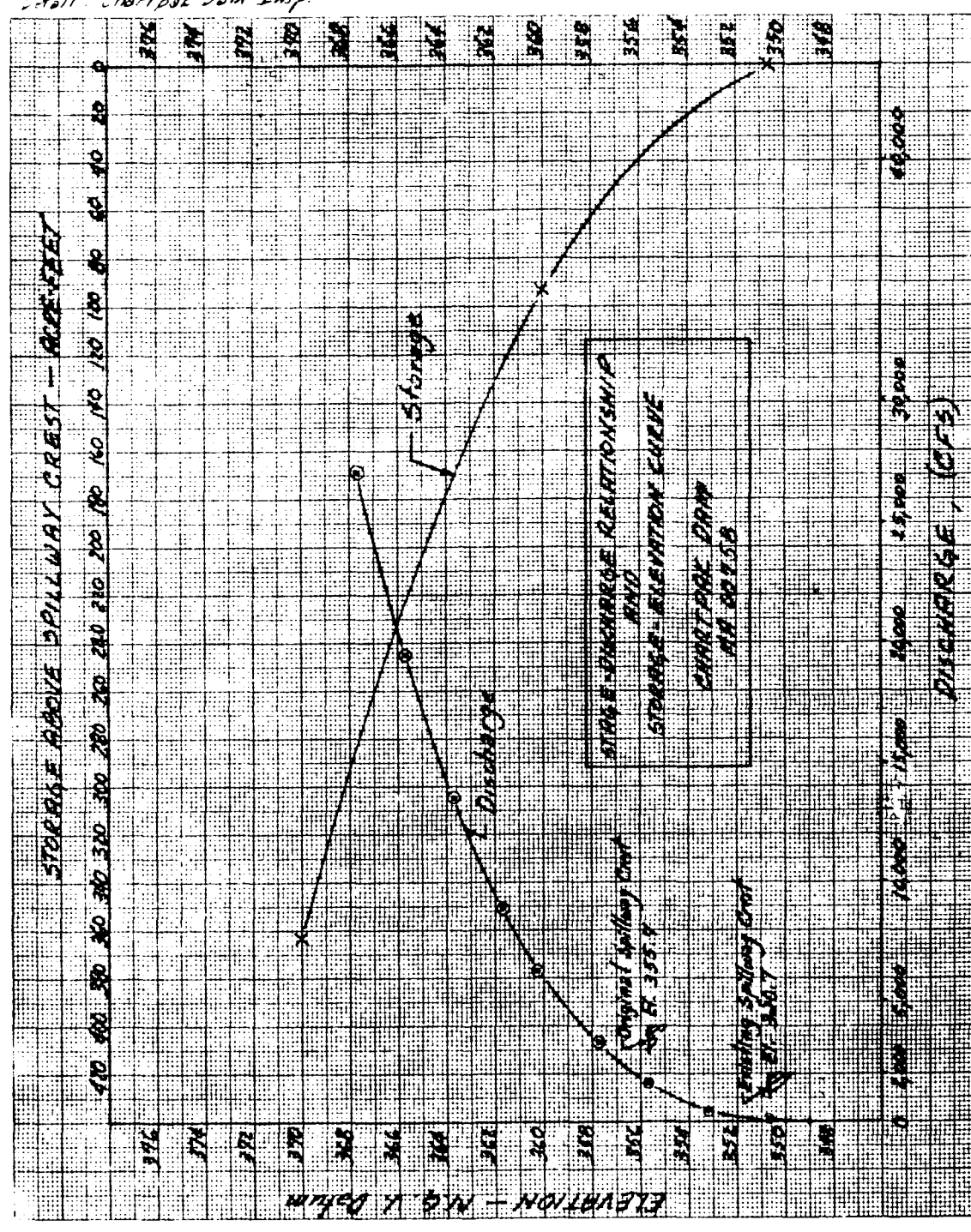
$$Q_T = 18,170 + 4,350 + 380 = 22,900 \text{ cfs}$$

Client: COE
 Detail: Chartpost Dam Imp.

Date: 11-30-74

4

NO. 319A, MILLIMETERS, 500 BY 500, VISIONS
 IN STOCK DIRECT FROM CODES & CO. WOODWARD, MASS. 01088



SURCHARGE-STORAGE ROUTING

Peak Inflow Test Flood, $Q_p = 25,100$ cfs

Surcharge Height is El. 367.2

$$STOR_1 = \frac{\text{Surcharge Storage}}{\text{Drainage Area}} = \frac{268 \text{ ac-ft} \times 12 \frac{\text{in}}{\text{ft}}}{40.2 \text{ sq. mi} \times 640 \frac{\text{ac}}{\text{sq. mi}}} = 0.125 \text{ inches}$$

$$\text{Probable Max. Flood} = Q_p = Q_p \left(1 - \frac{STOR_1}{9.5}\right) = 25,100 \left(1 - \frac{0.125}{9.5}\right) = 24,770 \text{ cfs}$$

Surcharge Height to Pass Q_p is El. 367.1

$$STOR_2 \approx \frac{264 \times 12}{40.2 \times 640} = 0.123 \text{ inches}; \quad STOR_{avg} = \frac{0.125 + 0.123}{2} = 0.124$$

$$Q_p \approx 25,100 \left(1 - \frac{0.124}{9.5}\right) = 24,772, \text{ say } 24,770 \text{ cfs}$$

$$\therefore \text{Peak Test Flood Inflow} = 25,100 \text{ cfs}$$

$$\text{Routed Test Flood Outflow} = 24,770 \text{ cfs}$$

$$\text{Surcharge Elevation} = 367.1 \text{ (NGVD)}$$

... OTHER IMPORTANT FLOWS

① Spillway Capacity with W. S. El. 360.2 (Overflow Spillway Crest)
from page 3, $Q \approx 6,250$ cfs

② Outlet Works Capacity The Outlet Works consists of a 4.5 ft dia conduit at the right spillway abutment @ Inv. El. 349.0, and a 2'W x 3.5'H sluiceway at the face of the spillway at Inv. El. = 341.5'. The sluiceway is completely silted in and cannot convey any flow

$$\therefore Q_{ow} = \text{flow through 4.5' } \phi \text{ pipe. Assume W/S at Lowest Spillway Crest, (El. 350.7)}$$

$$\therefore Q \text{ from page 3} \approx 45 \text{ cfs}$$

$$\text{From page 3, } Q_{ow} \text{ @ Major Spillway Crest (El. 355.7)} \approx 210 \text{ cfs}$$

CAMP DRESSER & MCKEE
Environmental Engineers
Boston, Mass.

CLIENT COE
PROJECT Dam Safety Insp
DETAIL Chartpak Dam

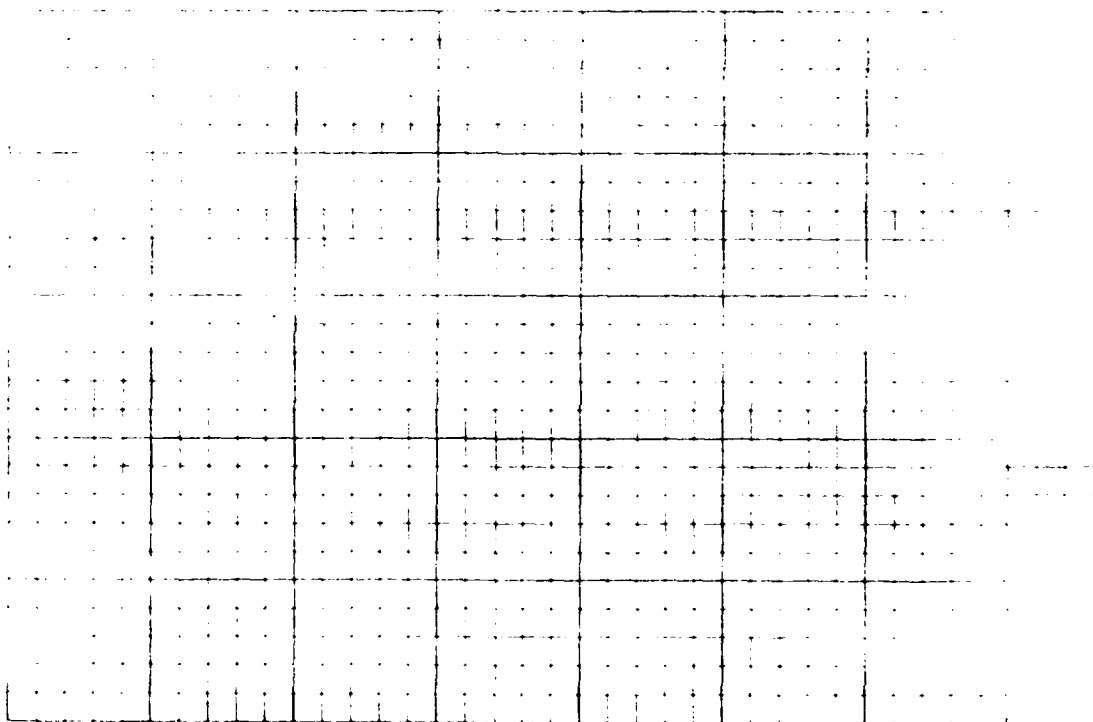
JOB NO. 380-6-RT-70 COMPUTED BY lee A
DATE CHECKED 12-10-79 DATE 11-30-79
CHECKED BY JED PAGE NO 6

TAILWATER ANALYSIS

The conveyancy of the channel downstream of the Chartpak Dam is shown on page 9. It was excerpted from the Flood Insurance Study for the City of Northampton, MA.

Extrapolating from the information given to the test flood flow of 14,770 cfs, the estimated backwater elevation is El. 349 ±

The existing spillway crest is El. 350.7, therefore there would be no tailwater effects on the discharge at the dam.



DAM FAILURE ANALYSISA. Dry Weather Dam Failure:

Determine Dam Failure Outflow, $Q_p = \frac{8}{27} g^{1/2} W_b (Y_b)^{1.5}$

where: $g \approx 32.2 \text{ ft/sec}^2$

W_b = Length of Failure Section. Assume the spillway fails: $W_b \approx 95 \text{ ft}$

Y_b = Hydraulic Height of Failure Section. Assume spillway fails along silt El. as measured at outlet works on U/S side and U.S. El. @ spillway crest (El. 350.7). Therefore, $Y_b \approx 3.0 \text{ ft}$. Silt level @ spillway is only about 3 foot lower than spillway crest.

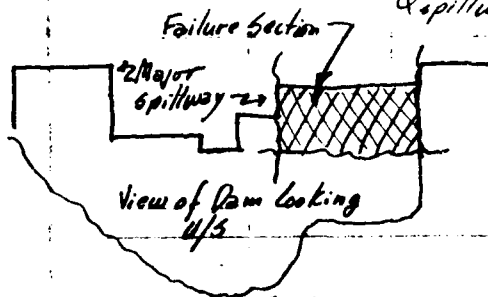
$$Q_p = \frac{8}{27} (32.2)^{1/2} (95) (3)^{1.5} \approx 830 \text{ cfs}$$

Such a flow can easily be handled by the downstream channel with a low hazard to development along the Mill River banks.

B. Wet Weather Dam Failure:

Determine Discharge at the Dam Prior to a Dam Failure, (Assume U.S. El. 360.2)

$$Q_{\text{spillway}} \approx \sum_{i=1}^3 C L H^{1.5} + C A \sqrt{2gh}$$



$$\begin{aligned} &\approx 3.4 (25) (9.5)^{1.5} + 3.2 (47) (7)^{1.5} + 3.1 (23) (4.5)^{1.5} \\ &\quad + (0.75) (15.9) \sqrt{\frac{1}{2} (32.2) (9.2)} \\ &\approx 2489 + 2785 + 681 + 290 \end{aligned}$$

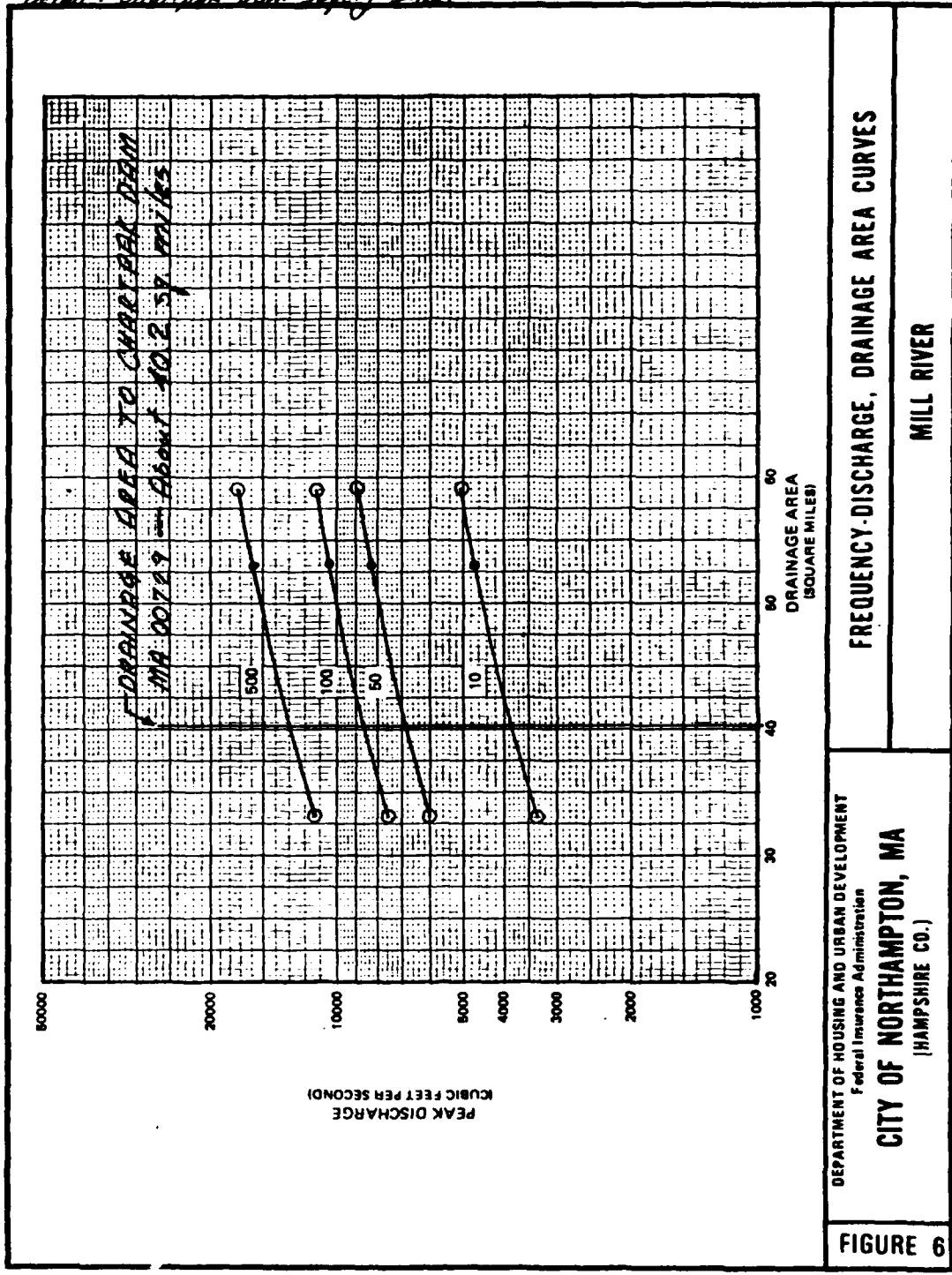
$$\approx 6,245 \text{ cfs, say } 6,250 \text{ cfs}$$

A discharge of 6,250 cfs is less than the 50-Year discharge of 6,800 cfs shown on the the Frequency-Discharge, Drainage Area Curves on the next page. These Curves as well as the flood profiles and the flood boundary maps were taken from the Flood Insurance study for the City of Northampton completed in November 1976 by the U.S. Army Corps of Engineers, New England Division.

Client: COE
 Detail: Chartpak Dam Safety Insp.

Date: 11-7-79

8



DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
 Federal Insurance Administration
CITY OF NORTHAMPTON, MA
 (HAMPSHIRE CO.)

FIGURE 6

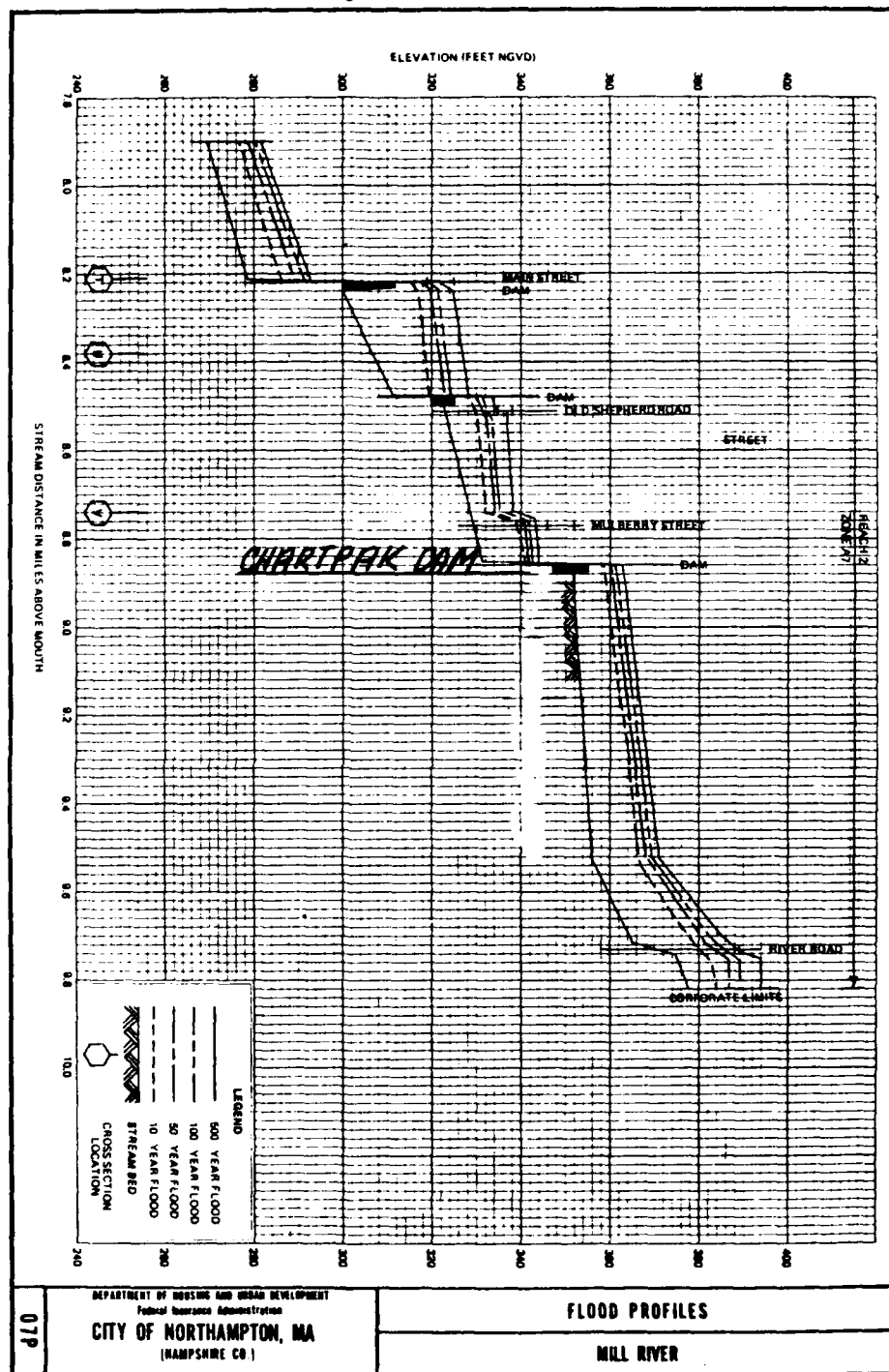
FREQUENCY-DISCHARGE, DRAINAGE AREA CURVES

MILL RIVER

Client: COE
 Detail: Chartpak Dam Safety Insp.

Date: 11-7-79

9



Date: 11-7-79



APPENDIX A: SCALE

Page 10

MATERNAL FLOOD INSURANCE PROGRAM

PLANT DIVERSITY AND FLOODWAY MAP

**CITY OF
NORTHAMPTON,
MASSACHUSETTS
HAMPSHIRE COUNTY**

COMMUNITY-PANEL NUMBER
250167 0001 A

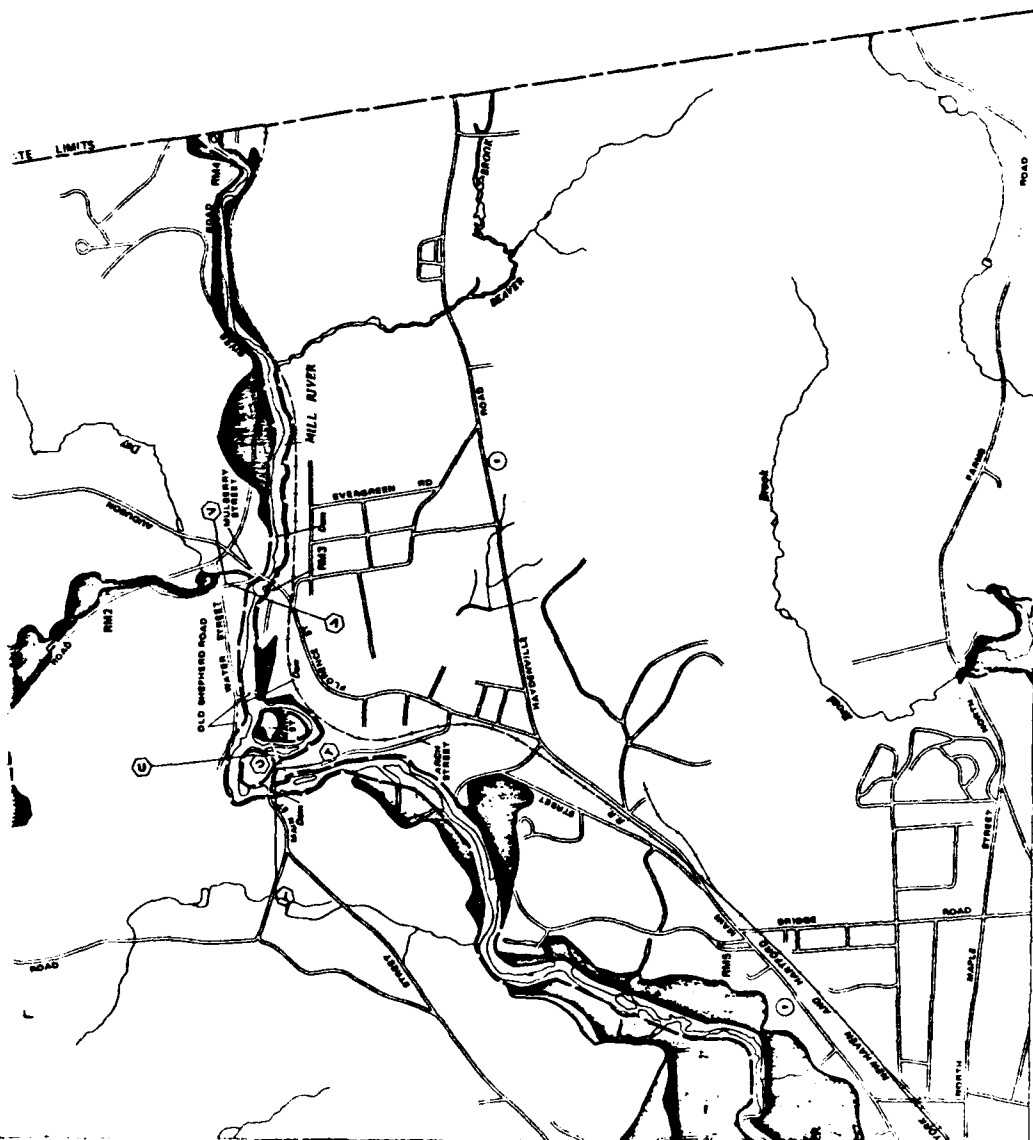
PAGE 1 OF 2

THIS WAS UNDER NO CIRCUMSTANCES TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM.

INVESTING
APRIL 3, 1979



U.S. DEPARTMENT OF HOUSING
AND URBAN DEVELOPMENT
FEDERAL HOUSING ADMINISTRATION



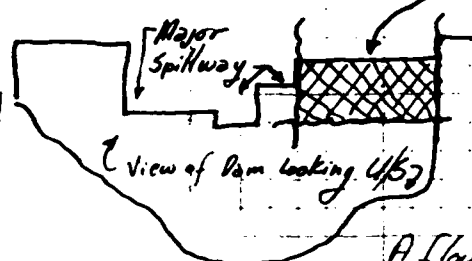
An analysis of the flood profiles and CDM Field Observations indicates that a flow of 6,300 cfs would overtop the river banks just slightly in the vicinity of Old Shepherd Road. No houses would be flooded due to a flow of 6,300 cfs.

Determine Wet Weather Dam Failure Outflow

Since the dam is silled on the upstream side to within a foot of the spillway, a dam failure along the spillway length would not increase the outflow at the dam significantly. However, it is quite possible that the overflow spillway could fail.

Assuming it would fail, the resulting dam failure outflow, with water at top of overflow spillway crest, would be:

Failure Section



$$Q_p \approx \text{Flow Prior to Failure} + \text{Flow Due to failure of Left Spillway Abutment}$$

$$\approx 6,245 + CLH^{1.5} = 6,289 + 3.4(75)(9)^{1.5}$$

$$\approx 6,245 + 6,885$$

$$Q_p \approx 13,130 \quad \text{say } 13,150 \text{ cfs}$$

↑ Head above
sill Elevation
at Left Abut.

A flow of 13,150 cfs is slightly greater than the 500-Year Flood flow of 12,600 cfs.

According to the flood profile for the 500-Year Flood, the water level between the dam and Mulberry St. would rise about 3 feet but would still be contained within the normal river channel by the stone walls along each bank.

Between Mulberry Street and Old Shepherd Road, the water level would rise about 7 feet and seriously endanger about 8 to 10 houses. The water level would rise to about window sill level at the mill on the left bank just downstream of Mulberry Street, which could possibly endanger employees at the mill. Old Shepherd Rd would be overtopped.

Between Old Shepherd Road and two dams just 200ft D/S of Old Shepherd Rd, water levels would increase

about 6 feet and would flood a house on the right bank.

Between the two dams near Old Shepherd Road and another Dam at Main Street the water level would rise about 6 to eight feet and flood two to three houses. Main Street would probably be overtopped.

Downstream of Main Street, the flood wave would attenuate at the large Northampton Country Club flood plain to a level similar to that existing prior to a failure of the dam.

Therefore, the increase in hazard above that existing due to the wet weather outflow prior to a dam failure would be

a "high" hazard.

APPENDIX E
INFORMATION AS CONTAINED IN
THE NATIONAL INVENTORY OF DAMS



INVENTORY OF DAMS IN THE UNITED STATES

IDENTITY NUMBER	DIVISION	STATE	COUNTY	DIST.	CORPS	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY MO YR
MA 750 MED	MA	D15	01			CHARTPAK DAM	4221.3	7242.1	14DEC79

POPULAR NAME	NAME OF IMPONDMENT
STARBUCK DAM	MILL RIVER
NEAREST DAM	NEAREST DOWNSTREAM CITY - TOWN - VILLAGE
01 08	MILL RIVER NORTHAMPTON
	POPULATION
	5
	27695

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STATUS HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPONDING CAPACITIES (ACRE-FT.)	RESERVOIR (ACRE-FT.)	DIST OWN	FED R	PRV/PED	SCS A	VER/DATE
P0807	1890	R	30	28	180	6	N	N	N	N	

REMARKS											
22-EST. BY OWNER'S REP. 24-27-ESTIMATED											
D/S HAS LENGTH	SPILLWAY TYPE	MAXIMUM DISCHARGE (CFS)	VOLUME OF DAM (CY)	POWER CAPACITY (KW)	INSTALLED PROPOSED	NO. LOCKS	NAVIGATION LOCKS				
1	220 U	95	6250								

OWNER	ENGINEERING BY	CONSTRUCTION BY
TIMES MIRROR INC.		

REGULATORY AGENCY		
DESIGN	CONSTRUCTION	OPERATION
NONE	NONE	NONE

INSPECTION BY	INSPECTION DATE DAY MO YR	AUTHORITY FOR INSPECTION
CAMP DRESSER + MCKEE INC	14NOV79	P.L. 92-367

REMARKS	
32-33- OVERFLOW SPILLWAY NOT INCLUDED	

END

FILMED

7-85

DTIC